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OCTOBER 23, 1937

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ELECTRICAL WORLD

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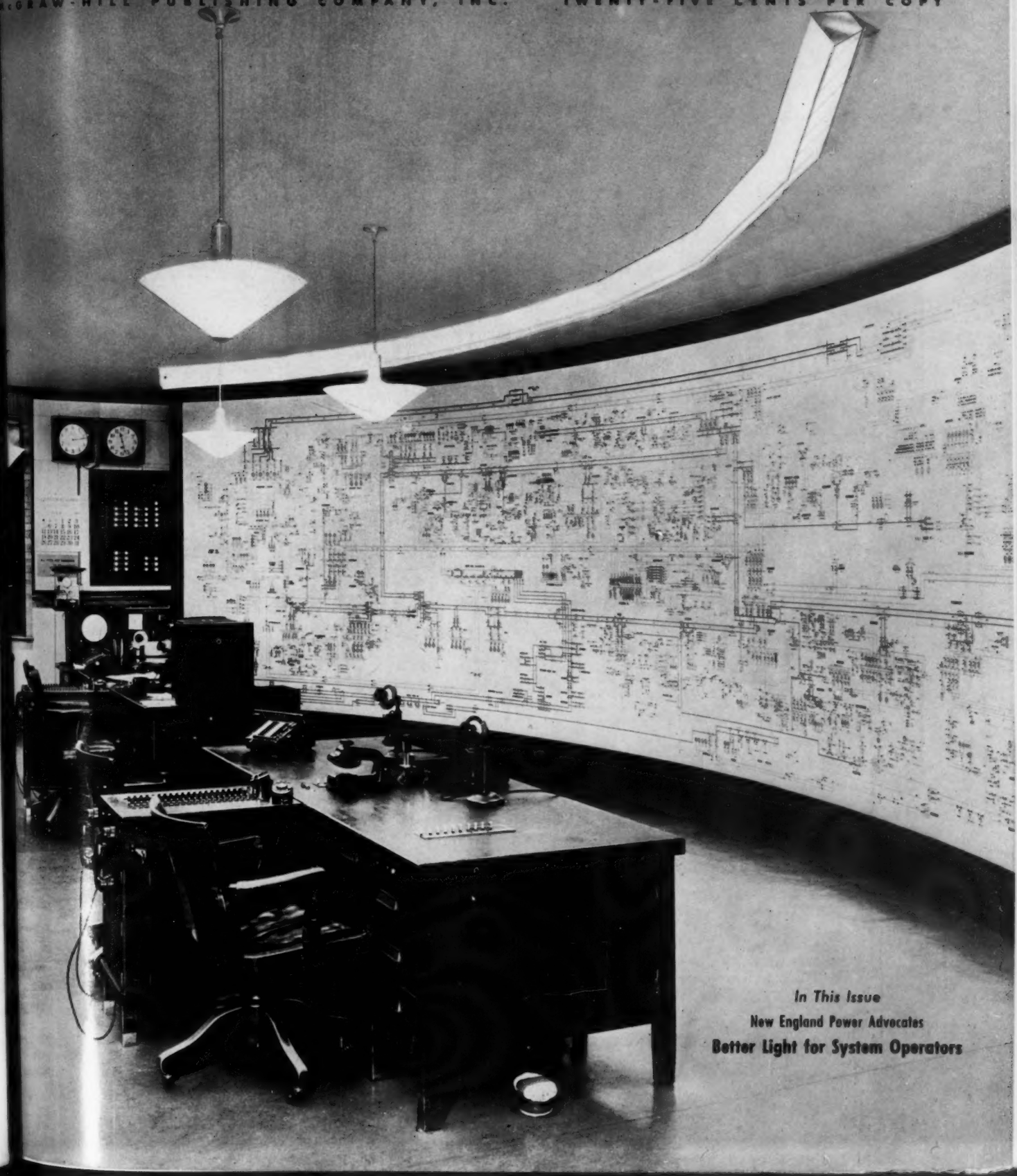


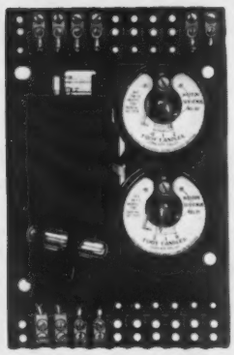
In This Issue

New England Power Advocates

Better Light for System Operators

Buffalo, too-

MODERNIZES STREET LIGHTING . . .



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ELECTRICAL WORLD

FOUNDED IN 1874 ✦ ✦ READ BY ELECTRICAL MEN FOR 63 YEARS

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Coming Features

Industrial Power Feature

ELECTRICAL WORLD's annual Industrial Power Feature, to appear November 6, will demonstrate the extent to which the technical advice of utility power sales engineers is being applied with profit by industry. Numerous specific cases will be cited covering the full range of power sales activities and quoting actual dollars and cents benefits to customers.

Compressed Air Saves At Forging Hammers

Substitution of compressed air for steam reduces operating costs and eliminates boiler plant in Eastern steel mill. Diversity holds down customer's demand charge.

Multiple Street Lights on Polarized Relay Control

American Gas and Electric Company's T. F. Hildebrand tells how one low voltage pilot wire controls both all night and midnight lights in replacement of series system at Roanoke, Va.

On the Cover

A view of New England Power's system dispatching room at Millbury, Mass., showing recent improvements in lighting and illumination, which are further described in an article in this issue.

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NEWS OF THE WEEK

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Letters TO THE EDITOR

Water Heating Carrier Current Control

To the Editor of ELECTRICAL WORLD:

In your issue of July 17, 1937, which has just reached me, reference is made on Page 43 by Mr. K. M. Robinson, of the Idaho Power Company, to the fact that electric water heaters in his company's district are controlled by carrier current.

He states that the salient features of this control have already been published in the ELECTRICAL WORLD, but somehow or other, I have missed his previous article which apparently gave the details of this method of control.

As I am at the present time interested in arranging for a similar method of control of water heaters in North Canterbury, I would be very much obliged if you could give me the reference to the article referred to by Mr. Robinson.

A. BUCKINGHAM,
Engineer Secretary,
The North Canterbury Electric-Power Board
Rangiora, New Zealand.

[It is interesting to note how an engineering development in one section of this country can by means of ELECTRICAL WORLD jump thousands of miles of land and water and influence a development in New Zealand. This is an excellent example of the influence of the engineering press in extending the electrical development of the world. The reference which Mr. Buckingham asks for is not a description of the Idaho carrier current control installation, but is "Carrier Current Controls Hollywood Street Lights" which appeared in ELECTRICAL WORLD for December 7, 1935. This article while devoted to street lighting control points out that this same control may be applied to off-peak loads.—EDITORS.]

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Falls Stumble in Stamps

To the Editor of ELECTRICAL WORLD:

Professor Fink's letter in the September 11 issue of the ELECTRICAL WORLD brings up a matter that is of considerable interest to stamp collectors. Many have wondered why in an effort to depict Niagara Falls on a United States stamp it should be necessary to show a view of the Horseshoe Fall as seen from the Canadian side of the river. Of course, American territory is visible, but it is decidedly in the background. The result may be looked upon either as a gesture of friendship to a neighboring nation or else as pure stupidity.

The counterpart is found in the Canadian 20-cent stamp, in which we have an excellent picture of the American Fall as viewed from Prospect Point, with the more spectacular Canadian Fall dwarfed into insignificance by perspective.

I think Dr. Fink's comparison of hydroelectric developments is rather overdrawn, in that, while British developments in the heart of Africa can have little but academic interest to Americans, the development shown on the Canadian 20-cent stamp, though now operated by the Hydro-Electric Power Commission of Ontario, was originally developed and built by American capital and primarily to supply a demand for power in the United States.

PERRY A. BORDEN,
The Bristol Company,
Waterbury, Conn.

•

Power Sales in Maine

To the Editor of ELECTRICAL WORLD:

Many citizens of the former 48 United States expect to find moose and bear in every clearing as soon as they pass over the line into the two remaining United States of Maine and Vermont. Many too, are of the mind that coal-oil lanterns are necessary when a native of these far North wilds goes to the well to hoist a bucket of water by hand. This naturally leads one of us natives, with a non-literary turn of mind, to hesitate, as this one has done, before attempting to proclaim his prowess as a power load producer.

A service which is rendered by the power department of this company, and one which is appreciated by our customers, is the drawing of plans and specifications for electrical work. Few industrials have full time electricians on their payroll; neither do their executives have much conception of a proper electrical layout for power and lighting in their plant. When an electrical job becomes necessary, almost any electrician is called in. He may, or may not, be qualified to do more than run 14-2 BX.

During the course of a year quite a few new industrials and large commercials establish plants in our territory. On his first contact, our power salesman offers to make complete electrical plans and specifications for the plant. These plans always allow considerable spare capacity for future growth and are in accordance with the National Electrical Code. The owner is supplied with sufficient copies of the plans and specifications so that he may receive three competitive bids on the work. This insures a fair cost of installation. Our engineer follows the installation while work is in progress to see that all material and workmanship is in accordance with the plans and specifications.

We find that contacts and friendships made with the plant owners and superintendents during an initial installation are very valuable to our company through the years to come. If each plant owner has some man in the power department of the utility in whom he has confidence to call in on his electrical problems the worries due to competitive power are few and far between.

DONALD M. LIBBY,
Power Engineer,
Cumberland County Power Light Co.,
Portland, Me.

•

Bibliography of Engineering Subjects

To the Editor of ELECTRICAL WORLD:

Will you kindly advise where we may obtain a copy of "Selected Bibliography of Engineering Subjects" recently published by the Committee on Professional Training, Engineers' Council for Professional Development, and mentioned in your September 25, 1937, issue of ELECTRICAL WORLD.

HOMER H. GRANT, Chief,
Division of Research & Statistics,
Department of Public Service,
Olympia, Wash.

[Several readers have written in to ask where the "Selected Bibliography of Engineering Subjects" could be obtained. It may be secured from the Engineers' Council for Professional Development, 29 West 39th Street, New York, N. Y., at a cost of ten cents per copy or five cents in quantities of fifty or more.—EDITORS.]

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Farm Production Studies

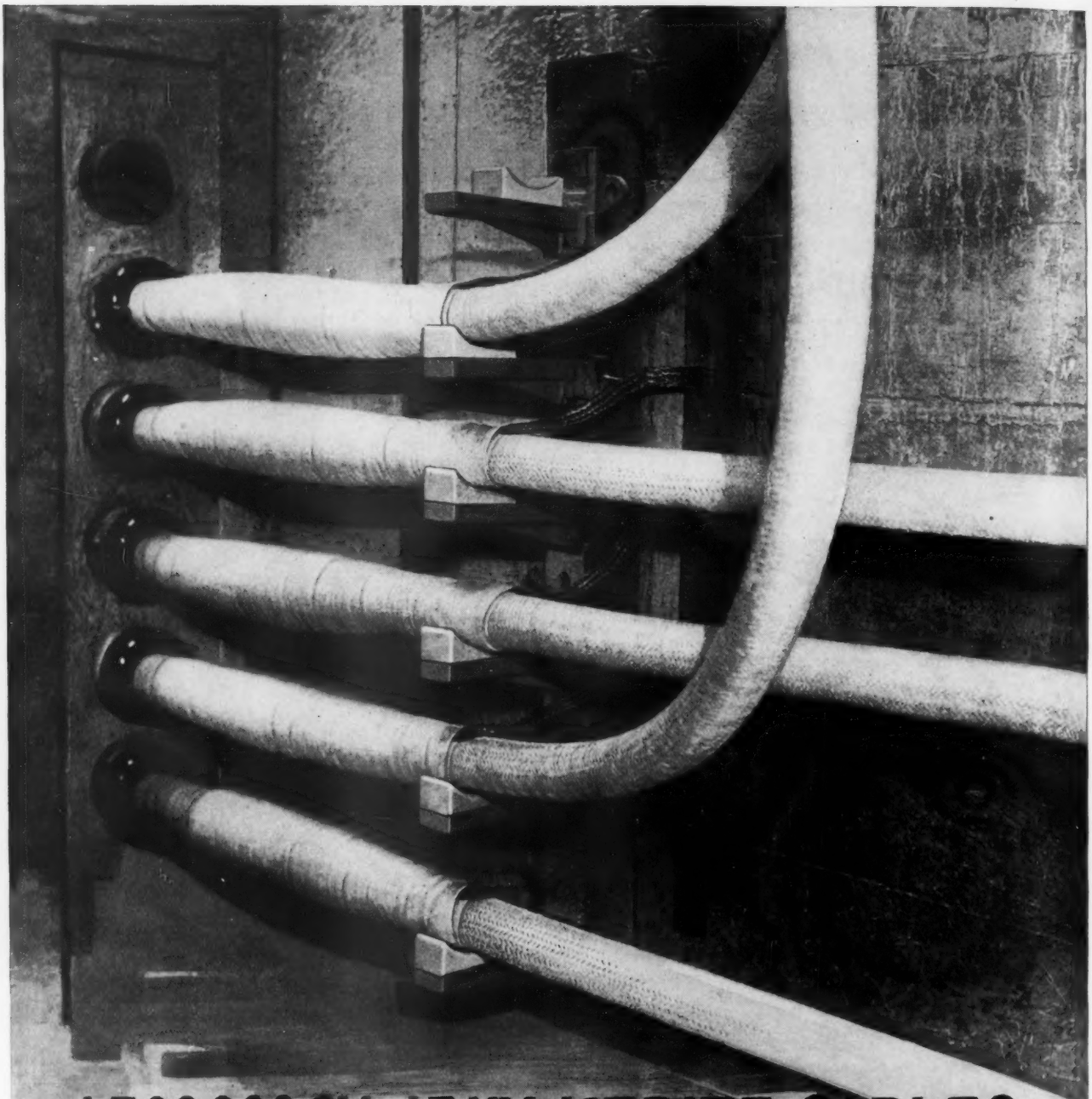
To the Editor of ELECTRICAL WORLD:

I want to compliment ELECTRICAL WORLD for the editorial on Page 93 of the October 9 issue, entitled "Farm Production Use Studies Needed."

You may be interested in some studies of the type mentioned in the second paragraph which have already been made and reported with the spray plant. In Purdue Bulletin No. 415 entitled "Comparative Costs and Efficiency of Stationary vs. Portable Spraying" is given the hours of labor required for spraying a certain orchard area with portable and stationary equipment. There is also shown the difference in labor and power cost per 100 gallons of spray material applied for the two methods. From the standpoint of labor alone, more than 20 per cent less was used with the stationary plant than with the portable to apply 100 gallons of spray material.

I know of no other experiment in the United States where both types of spraying equipment have been compared on the same block of orchard and hope that you will find these figures of interest.

TRUMAN E. HIENTON,
Associate in Agricultural Engineering,
Purdue University.



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INSTALLED 1927

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NEW YORK CHICAGO SAN FRANCISCO

ELECTRICAL WORLD

OCTOBER 23, 1937

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Postponement of Expansion Unwarranted by Market Conditions

Early this spring business economists predicted a recession in business this fall, but it was to be a mild slowing down in acceleration as a sort of breather before another upward movement. The slowing down in bookings came a little earlier than was expected. What the market forecasters did not anticipate was the stock market weakness.

In fact, even at this writing there does not seem to be any generally accepted reason for the severity of the current break in the securities. It was obvious that much of the commodity buying last fall and early this year was of a forward nature as a hedge against higher prices. For that reason, a slight recession in bookings was expected until inventories had been reduced. Unfortunately, the break in the stock market being more severe than was warranted by an overstocked commodity situation, doubt and uncertainty arose, with the result that buying commitments which would normally be made at this time are being held up pending further developments.

The recession in industrial production is being reflected in the weekly energy output chart. Energy production, while still greater than last year at this time, is below the summer figures. It may even be found that the peak week was the week before Labor Day, and it is possible that the output curve for the first three months of next year might go below the 1937 first quarter production. Beyond that it is not possible to predict, except to say that a pessimistic outlook is not warranted. To postpone commitments for additional system and station capacity in the belief that lower outputs will be reached and maintained for some time does not appear to be wise.

In some respects this might be called a breathing spell, which was most fortunate as it lengthened the time during which the industry could prepare itself for the peaks of the future. There is no doubt but what these peaks will come.

The problem, of course, is going to be to forecast the growth in load. There is nothing in the history of the past six or seven years that can help very much except to say that the 1935-37 curves of growth should not be taken as the new trend lines. Percentages cannot be piled on top of percentages of growth indefinitely.

We must not forget that in 1935 and 1936 industrial output was coming up to capacity. After capacity was reached a substantial increase in energy use would depend upon increased industrial capacity, and that takes time. Therefore to get a picture of future growth trends it would be better to go back to those years when industrial capacity was increasing and see what the effect was on energy output.

Inasmuch as manufacturing capacity for generating equipment is booked well ahead, it is most advisable to seek factory production time reservations at the earliest possible date. If the forecasts show a possibility that additional generating capacity may be needed any time during the next three or four years, now is the time to make commitments. Any delay at this time because of unsettled current business conditions may prove very embarrassing and costly later.

Consolidated Edison Company of New York, Inc

SUBMARINE CABLES CROSS LITTLE HELL GATE

A construction crew pulls in one of six 13,200-volt, lead-covered, steel-wire-armored submarine cables installed to supply New York's new Sewage Treatment Works on Ward's Island. Running 1,450 feet from submarine manholes on Randall's Island to those on Ward's Island, under famous Hell Gate Bridge, cables are part of a system to link the plant with the Hell Gate generating station, which can be seen in the center background.

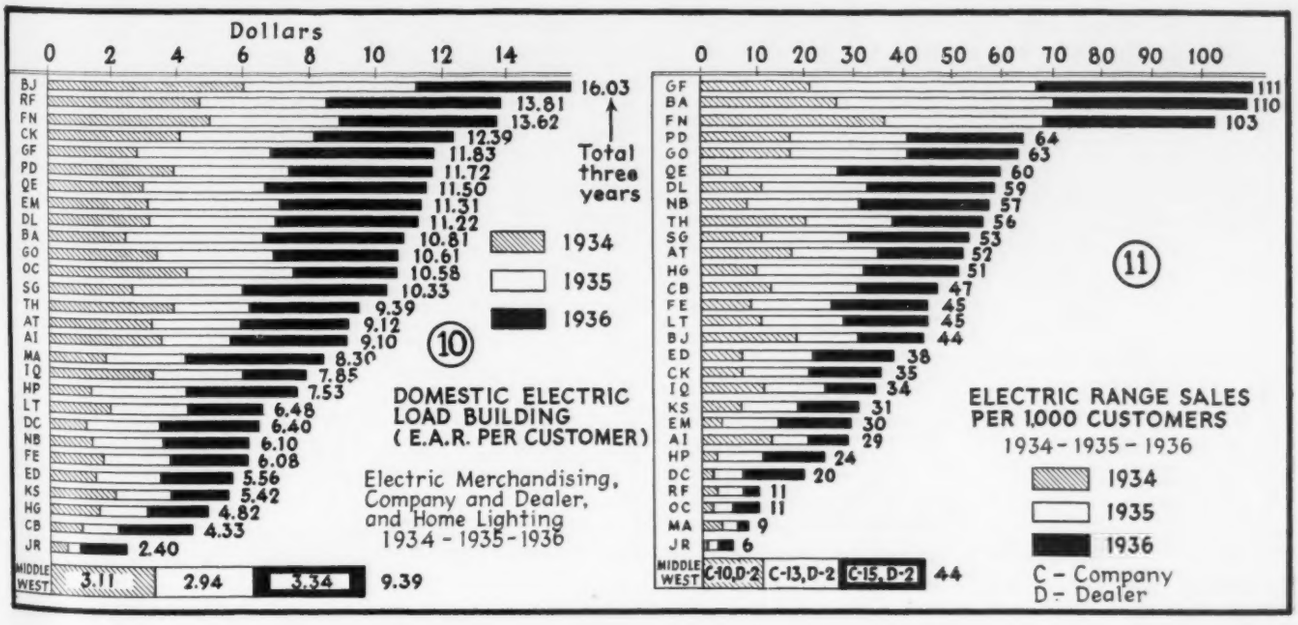
Three Years of Load Building

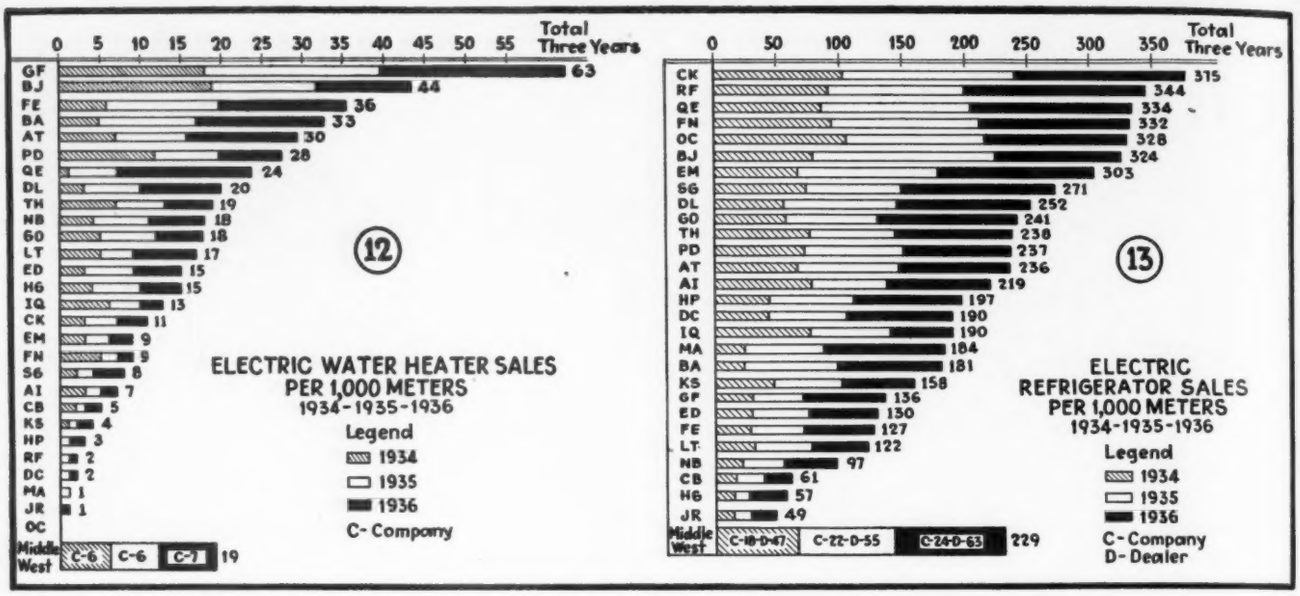
Figures of 28 Operating Companies of the Middle West System Show Importance of Residential Loads

ONE of the most interesting points developed by the survey of results of 28 operating companies of the Middle West system was that the added residential load brought a rate of 3.09 cents per kilowatt-hour. (See ELECTRICAL WORLD, October 9, 1937, page 68), compared to an industry figure stated to be 2.10 cents. According to records of the Middle West system, the operating companies have the following saturation ratios of major appliances: Refrigerators, 31.1 per cent; ranges, 8.4 per cent, and for water heaters, 1.9 per cent. As the industry figures are respectively 41.1 per cent, 7.9 per cent and 0.78 per cent, it is of interest to see how the various classes of load contributed to the increment revenue, with due consideration given to rate reductions during the three-year period.

Total E.A.R. affecting the residential business originates from the sale of electric merchandise by the company, by the dealer and from the promotion of home lighting, all of which are combined and shown by years for each company in chart 10. The figures at the end of the bars show the sum of the E.A.R. from all three sources secured in the three years. The average for the Middle West system is $9.39 in E.A.R. per residential customer in the past three years. There have, of course, been many rate reductions and also a rather large increase in number of customers, most of which are small users. While the actual gain in revenue per customer as shown by operating records is, in most instances, somewhat less than the E.A.R. would indicate, the effect of load building is nevertheless reflected in residential revenues. Operating reports show that since 1933 total residential revenues have increased 21.2 per cent in spite of rate reductions averaging over $6 per customer in the years involved. The actual increase in revenue caused by improved conditions as well as by load building, plus the rate reduction which had to be overcome, equals more than $10 per customer, which is something over the E.A.R. per customer reported on this chart.

A breakdown of the sales of the three major appliances per 1,000 domestic customers by companies and divided to show dealer sales and company sales is provided by the next three charts, numbered 11, 12 and 13. As might be expected, sales of ranges and water heaters are made by the companies rather than by the dealers. From a comparison of the companies listed on chart 12 with the gain in sales shown on chart 14 it will be noted that the companies selling the largest number of water heaters show the largest gain in kilowatt-hour sales.





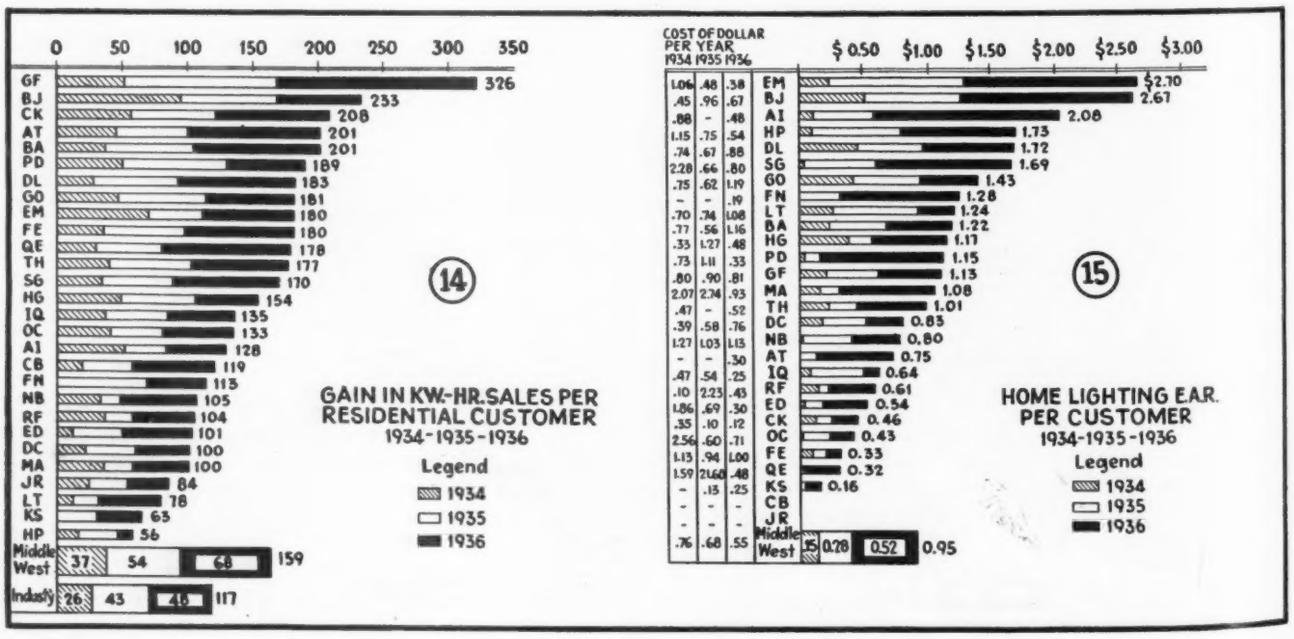
With a better saturation of the larger load-building devices now in general use, combined with aggressive promotion of lighting and smaller load-building devices to low-use customers, it may be profitable for operating companies to gain from 100 to 200 kw.-hr. in average consumption per year.

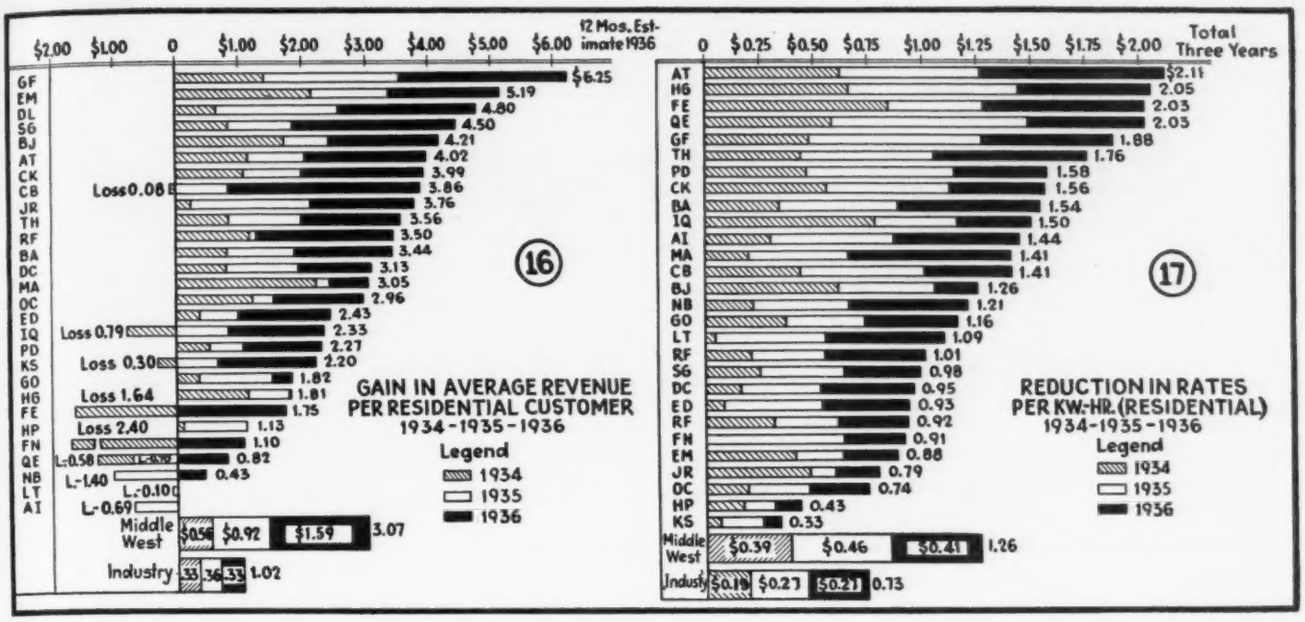
The cumulative effect that the domestic refrigerator has had on utility consumption and revenues can be understood when it is known that on Middle West properties there have been 133,000 domestic refrigerators sold by company and dealer in the past three years compared to the sale of 25,000 electric ranges in the same period and 11,000 electric water heaters. While most of the records on chart 13 have been made in southern territory, some of the companies in the northern tier states rank well up in the list. The electric refrigerator is still one of the greatest aggregate domestic load builders of all household appliances.

It has been shown (chart 10) that domestic E.A.R. added in three years was $9.39, of which $8.44 came from merchandise load building (chart 9). The E.A.R. from home lighting, amounting to 95 cents, is shown on chart 15.

Note the proportion of the heavy black line designating 1936 accomplishments to the previous two years. More has been accomplished in 1936 than in the two previous years combined. Costs of promoting home lighting have gone down each year (see also chart 5), and greater production per person employed has been experienced. Home lighting undoubtedly offers one of the real opportunities for developing revenue among small users. During two months of 1936 the E.A.R. produced by all companies from home lighting exceeded the E.A.R. from the sale of electric merchandise by the companies.

With respect to the all-important figure of revenue per customer (chart 16) it will be noted that the Middle West average gain in revenue per residential customer has been $3.07, compared to a gain by the whole industry of $1.02. Furthermore, Middle West made greater gains in 1936 in revenue per customer than in the two





years preceding. Only two companies show revenue per customer at the end of 1936 less than in 1933, although several lost revenue in 1934 and 1935.

Reductions in average rate shown on chart 17 are of course the results of rate reductions plus the effects of greater use. In general, those companies that have made the greatest gains in average consumption also show the greatest reduction in average rate. Middle West average rate has decreased more rapidly than the average rate of the whole industry. Greater use will permit lower average rates, without sacrificing earnings to a dangerous point.

Critics of the industry who have never been employed by it or in it assert that lowering of electric rates has resulted in increased usage such as is shown here. The facts dispel this fallacy, show it to be false. The customer seldom increases his usage purely because rates are reduced. This is established by the fact that after a rate reduction the company has to go out and sell more load in order to hold the bill up to somewhere near its level before the rate reduction was made effective by the utility company.

Finally, as shown here, the load-building effort must be distributed to give a satisfactory return. The relationships shown here are those selected by a leading service organization to achieve a desired result. Added kilowatt-hours came from major appliances and as well from lighting and small appliances. From the details, given in complete array in this article, is seen the emphasis placed on each division of the job by a large number of companies to build the kind of load which was desired.

Ample Farm Load Requires Ample Farm Outlets

From address by J. M. McNEILL, Appliance and Merchandise Department, General Electric Company, over stations WGY and W2XAF

IN GENERAL, there are three types of outlets used in farm wiring systems—the light outlet in which the lighting fixture is installed, the switch outlet for the control of lights, and convenience outlets for plugging in portable lamps and appliances.

A sufficient number of convenience outlets will allow the simultaneous use of a number of portable lamps and appliances and will provide the means for making every home and farm veritable electrical workshops. Nothing is so vexing as to have to disconnect a fan on a hot day so as to be able to use a hand iron, or to have to disconnect a lamp in order to plug in the radio. The lack of outlets is a sign of electrical deficiency, and it can be easily avoided.

For the efficient use of electricity, an outlet should be installed to approximately every 12 feet of wall space in rooms. Switch outlets for light control should be installed at each entrance to a room, thus assuring a pathway of light through the home. There should be switch controls in upper and lower hallways to regulate lighting from each point. Yard and barn lights should have dual controls for the sake of convenience and economy.

In the barn and barnyard and in the farm shop power outlets should also be provided for the use of motors and other electrical equipment.

It is more economical to plan for a sufficient number of outlets when wiring is installed, but additional outlets can be added to existing wiring systems without a great deal of expense. Where the increasing use of electrical appliances and farm equipment make it advisable to expand an electric service, wiring modernization will prove a worth-while investment. It always pays to "keep an eye to the future."

Trial and Rental Plans Steps to Outright Selling

Results of Four Major Appliance Campaigns Indicate the Pitfalls of Trial Plans Compared to Advantages of Sales Plans

By L. A. FALK
Merchandise Sales Manager, Wisconsin Power & Light Company, Madison, Wis.

WHEN a utility has pulled itself over the first hump of the water heater business—that is, has actually started in the business and has proved to itself that customers will buy and use water heaters—then it will find that special emphasis on free trial and rental offers is neither needed nor desirable as promotional and selling effort continues. At least this is the conclusion that appears from the experience of the Wisconsin Power & Light Company. This experience covers gas as well as electric water heaters and the lesson from it appears to be applicable to both.

The company put on its first water heater campaign in the spring and summer of 1935. Free trial for 90 days was the feature of the campaign, was extensively advertised and was set forth in a free trial agreement order to be signed by the customer. Of the resulting 596 heaters installed, 16 per cent reverted. This campaign tried to do too much in too short a time. A local shortage of heaters and of installation materials developed. The salesmen sold the free trial instead of the value and performance of the appliance.

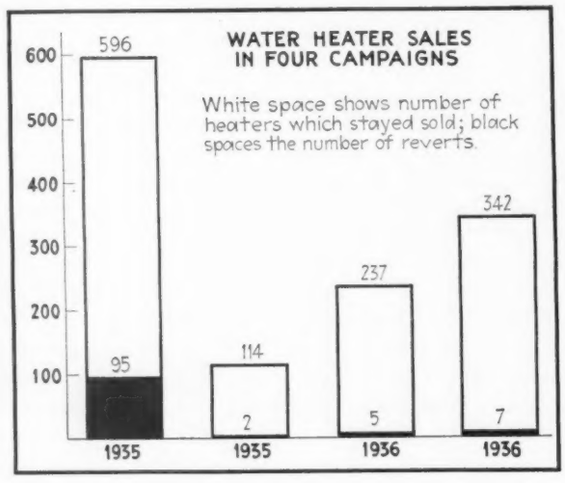
Reverts were much too high and the compensation of salesmen became a troublesome matter. But the campaign was effective in establishing the company in the water heating business, both in the minds of customers and of company management.

The next campaign, in the fall and winter of 1935, embodied a rental-purchase plan, widely advertised and stated in a special rental order form. There were less than 2 per cent reverts and 112 heaters stayed sold. But again the salesmen sold the plan and not the water heater and again salesmen's compensation was a difficulty. Also, there arose some customer misunderstanding as to the terms of rental and purchase.

Free trial, this time for 60 rather than 90 days, was again included in the spring and summer campaign of 1936, but was not made a feature of the campaign and was not played up in the advertising. The free trial agreement order was again used. Reverts were less than 2 per cent from the 237 heaters installed. But the salesmen remembered some bad experiences they had the previous summer and did not like the free trial idea. Compensation difficulties again arose and a second selling job had to be done to get the contract at the end of the trial period.

The lessons learned from the three preceding campaigns were applied in the fourth, which was carried on in the fall and winter months of 1936. This campaign was built around a "winter payment" plan—$1 down and $1 per month for five months and the balance on regular cash or payment terms. Regular merchandise sales contracts were used and the terms of the plan were not featured in the advertising. Reverts again were under 2 per cent and 342 heaters were installed. This sales activity exhibited definite advantages over the others. It proved the low operating cost of water heaters over a cold weather period of five months. The heater was sold when the order was taken and no call-back at the end of a trial period was necessary. The matter of salesmen's compensation became definite and clear cut.

In all four campaigns dealers were invited to sell on the same terms as the company, with the company carrying the dealers' accounts. If a dealer sale was repossessed the company took over the water heater and the account and the dealer was charged with the installation cost. Very few dealers participated in the campaigns, but the record shows that sales were greatly stimulated for those who did.



Free trial featured first campaign and established a customer consciousness of electric water heating. Rental-purchase campaign was succeeded by payment plans minimizing trial feature

General view showing location of three electrostatic air cleaners, power packs and door switches in the Field Building

Air Electrically Cleaned in Chicago Building

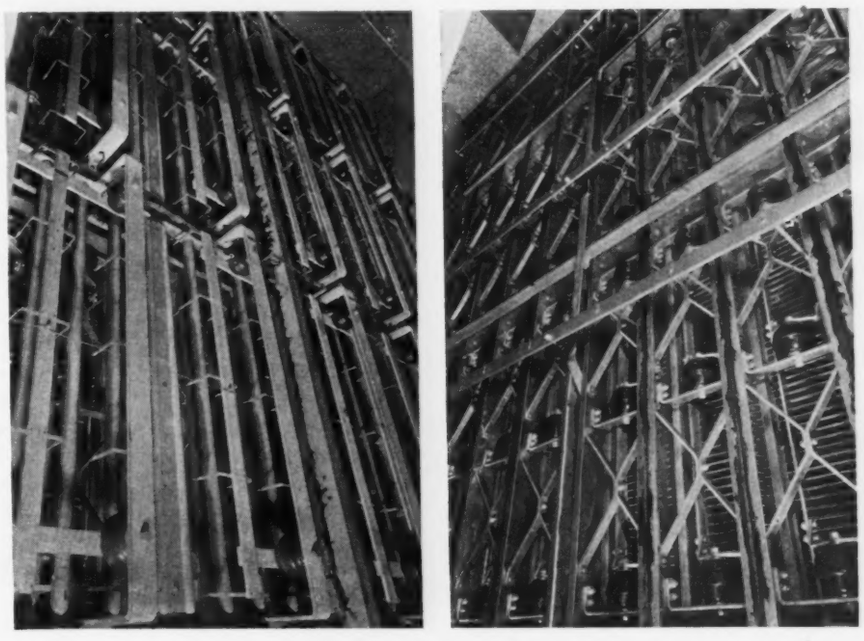
Electrostatic Air Cleaners to Handle 272,000 Cubic Feet Each Minute in First Major Installation in Chicago

FIRST major installation of an electrostatic air cleaner for office building air conditioning has been made in the Field Building, tallest in Chicago's Loop, by the Westinghouse Electric & Manufacturing Company. The installation is in five sections in different fan rooms, one in the basement and one each on the first four floors. The eighteen units comprised in the five sections are capable of cleaning 272,000 cubic feet of air each minute.

In a year's time, it is estimated, the installations will have collected approximately 600 bushels of impurities, 90 per cent of which will consist of particles one-hundredth the diameter of human hair. By weight, the collection will consist of one-third ash, another third fixed carbon, soot, lampblack and other derivatives and the remaining third volatile matter such as oils and greases. Sulphur, bacteria, pollen in season, and other substances found in suspension in the atmosphere of any city, are also deposited on the plates. Which is not remarkable when it is considered that dirt deposited out of the air in the Loop area averages a thousand tons per year per square mile. Dust particles so small that they flow through any mechanical filter are removed by this process of electric precipitation. Impurities are taken from the air, not by sifting them out mechanically, but by charging all particles electrically and then pulling them out as they pass through an electrostatic field, in a manner similar to that by which a magnet attracts iron filings.*

Energy costs to operate the equipment are insignificant. A unit for the average home requires about as much current as is consumed by a 60-watt lamp, and the Field Building system, cleaning air for the lower arcade, the first, second, third and fourth floors, will have an energy requirement of less than one kilowatt.

* See "Dust Precipitator for Air Conditioners," page 112, ELECTRICAL WORLD, October 9, 1937, for details of operation.



Electrostatic cleaning elements

At the left is the entrance side of one of the 22,500-c.f.m. air cleaners which are composed of thirty 750-c.f.m. cells. Dust particles in the air entering the cells tend to collect electrons in the ionizing zone between the tubes at the left where high electrostatic concentration exists. Becoming thus negatively charged the particles are attracted toward the grounded or positive plates in the background. Here they are deposited and the clean air emerges from the side of the cell shown at the right.

Distribution Economics Gain Through Trouble Analysis

Analysis of Interruptions Guide Utility Engineers Toward Reduced Outage and Operating Cost and More Friendly Public Relations

By W. B. ELMER
Head of Distribution Technical Division, Boston Edison Company

WHEN the operating records of generating, transmission and distribution systems are analyzed and compared it will probably be found that certain systems are relatively out of balance economically. The "service standards" (S. M. Dean, Detroit Edison Company, Edison Electric Institute, Chicago, June, 1933) of the different systems may not be congruous. It is likely to be the case that with most operating companies the primary distribution systems have not been designed to give adequate reliability when compared with the remaining systems. This may be largely due to the unfortunate older practice of weighting service reliability on the basis of judgment alone, coupled with a lack of adequate analysis of trouble and outage data. If customer outage can be evaluated and assigned a monetary equivalent, a powerful new tool is provided for use in the many economic studies which are necessary to bring the systems into better economic balance.

Service operators in Boston trouble dispatching office

From study of the trouble and outage record it may be observed that certain subdivisions of the system are operating so free from trouble that they can be adjudged as having been designed with excessive safety factors. This indicates that the simplification or elimination of certain apparatus in this subdivision would save considerable money without appreciably increasing trouble and outage costs. Conversely, other classes of trouble can be found where a very moderate outlay of money will make a sizable reduction in trouble and outage rates. By diverting funds from over-reliable to under-reliable apparatus the outage will be greatly reduced without materially increasing the net cost of the system. Thus, if the possible saving by using bare line wire for secondaries were to be allotted to defray the increased cost of adopting a primary line wire with an improved covering, it might work out that the resulting net cost of line construction would be equal to or less than the existing cost, whereas the amount of customer outage would doubtless be vastly reduced.

Since 1933 troubles on our system have been approached solely on a complete statistical basis, with a resulting sharp decrease in distribution failures, outage rates and operating costs. Over the seven-year period from 1929 combined troubles on the transmission, primary and secondary distribution systems have been cut about 40 per cent and customers' service correspondingly improved.

When all distribution system troubles are adequately recorded and tabulated, the types which are most numerous and cause the greatest net outage become conspicuous and may be subjected to special study. For such kinds of trouble several alterna-

Troubles and Correctives Classified

Class of Trouble	Corrections
1. Natural conditions.....	(a) Study adequate design and construction methods.
2. Foreign agencies.....	(a) As above; (b) educate public; (c) obtain co-operation of other utilities.
3. System inadequacy.....	(a) Finance plant modernization; (b) increase personnel to complete inspections on experience-determined plan.
4. Defective equipment.....	(a) Improve specifications and inspection, equipment and material; (b) standardize materials and apparatus; (c) establish or increase field inspections.
5. Personnel failures.....	(a) Educational programs; (b) improve supervision; (c) issue specifications and rules.
6. Unknown.....	(a) Conduct or increase technical fault analysis.

tive methods of correction may suggest themselves. Not only must the adopted method be economically justified, but it must offer the widest margin of saving. A classified daily record provides fully detailed information for these individual studies, rendering tedious search through bulky trouble files needless.

Besides pointing out the specific weakness in a distribution system, trouble analysis may be so arranged as to give the management a clear conception of the general weaknesses in the organization. There are six general trouble-cause classifications, with corresponding broad correctives, as shown in the accompanying panel.

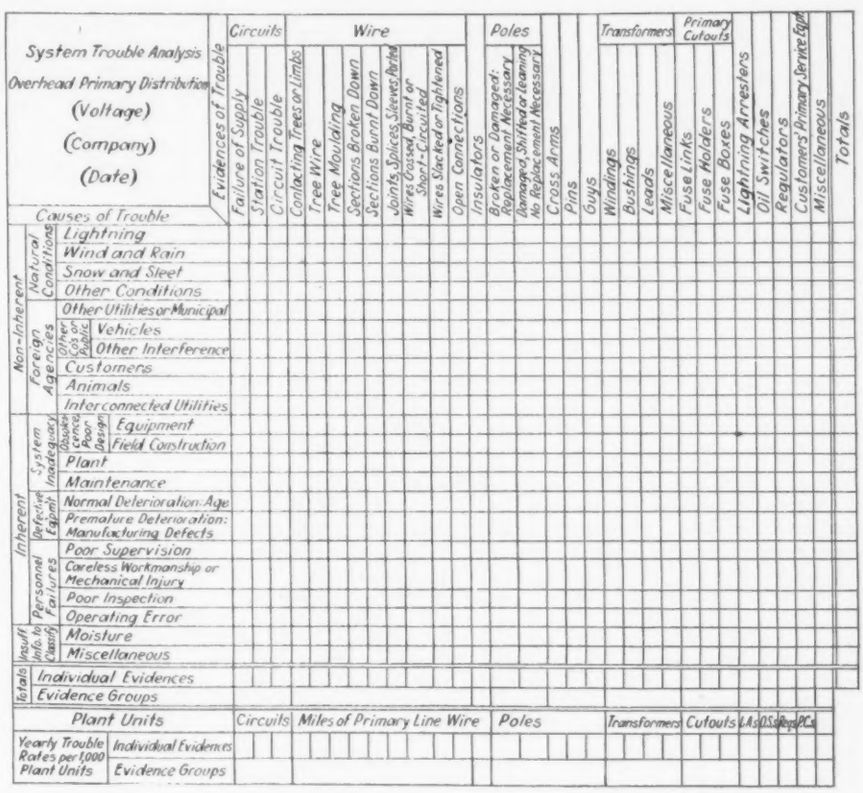
Troubles fall naturally into two main divisions in point of seriousness —those which cause service outages and those which do not. Some of the larger operating companies supervise these from a central dispatching office, with continuous and comprehensive records on 24-hour bases. Minor troubles are customarily reported by the man who makes the repairs, such reports forming valuable adjuncts to the dispatcher's daily report. There is some indication that it would be desirable to make more provision for recording details of even minor troubles attended to by line crews, as these may aid in preventing easily correctible weaknesses, sometimes of long standing and casual discovery.

Customer outage due to transmission and primary distribution trouble is usually recorded in terms of kva.-hours of connected transformer capacity affected. Outage due to secondary troubles is recorded in terms of customer service-hours or meter-hours affected, which can later be converted into equivalent kva.-hours by the use of suitable average factors. A typical form for the tabulation of overhead primary distribution troubles is shown, with "causes" and "evidence" indicated.

System trouble analysis in a commonly used form may enable different utilities to compare operations on a common basis and to prove the relative success of various engineering and construction methods. Having determined from trouble analysis which items deserve most attention from the viewpoint of frequency and service outage, ways and means are considered for remedying these troubles economically. The problem in each case is to compare existing net operating costs against estimated operating costs after applying the proposed corrective. These are most satisfactory when made on an annual basis, rather than on the basis of total initial costs, because operating and maintenance charges are not easily included in lump-sum comparisons.

Table I illustrates one of the uses of trouble analysis applied to a hypothetical average overhead distribution system. These data show that wire and tree troubles are the most serious causes of customer outage on overhead systems and demand first consideration in improving service. Although wire troubles occur at about the same rate on both primary and secondary systems, the customer outage rate from primary troubles is about forty times greater than that due to secondary wire troubles. This strongly indicates that the common use of identical types of supports, insulators and conductors for both types of distribution circuits should be questioned. Secondary construction may be too expensive for the needs of the service and primary construction inadequate.

Typical important corrective measures guided by economic studies are: (1) The application of lightning arresters to distribution transformers in areas of high trouble rate and to primary riser cables where sheaths are isolated from station grounds; (2) discontinuance of tree insulator use in favor of wax-impregnated tree molding; (3) double spacing of primary wires on crossarms; (4) modernization of distribution transformers; (5) extensive tree trimming.



Typical trouble analysis form for utility service

Table I — Condensed Annual Trouble Record

Primary Distribution	Number of Outage Troubles	Avg. Outage per Trouble in Connected Kva.-Hrs.	Avg. Secondary Customer Outage in Minutes per Year
Circuit interruptions per 1,000 circuits	150	225	2.0
Tree troubles per 1,000 miles primary wire	12	300	3.0
Wire troubles per 1,000 miles primary wire	18	360	6.5
Pole troubles per 1,000 poles	0.1	200	0.8
Transformer troubles per 1,000 transformers	9.0	50	0.8
Fuse troubles per 1,000 fuses	10.0	20	0.5
Switch troubles per 1 000 switches	9.0	1,000	0.9
Miscellaneous troubles per 1,000 miscellaneous units.	25.0	....	0.5
Total			15.0
Secondary Distribution			
Tree troubles per 1,000 miles secondary wire	8.0	5.5	0.07
Wire troubles per 1,000 miles secondary wire	20.0	4.5	0.15
Pole troubles per 1,000 poles	0.4	5.5	0.03
Miscellaneous troubles per 1,000 miscellaneous units.	0.2	....	0.25
Total			0.50
Grand total			15.5

The comparative absence of outage due to secondary distribution failures as shown by trouble analysis has been a guide to such changes as: (1) Simplification of riser construction; (2) general reduction in secondary cable insulation and sheath thickness; (3) adoption of less expensive grades of rubber insulation for secondary wires and cables.

For illustration let it be assumed that in addition to the existing practice of using tree wire and tree molding, and regularly trimming trees, three new methods of reducing line troubles are investigated through economic study as in Table II.

The conclusions from this study, drawn on the basis that the application of any corrective should show an appreciable profit and on the basis of the stated assumptions only are: (1) New primary line extensions should be made with improved line wires installed in alternate positions on the crossarms; (2) when vacant pin positions are available on primary crossarms, wires should be installed with double spacing, both on new and existing plant.

For further illustration, Table I showed that the most serious individual trouble which can occur is an oil switch failure, producing an average service outage of 1,000 kva.-hours of connected transformer capacity. The average cost of an oil switch failure is the sum of (a) average outage times average cost per kva.-hour of outage plus (b) cost of damage to switch plus labor for replacement. If this is $350 per switch failure, for example, then with the given failure rate of nine per 1,000 switches per year, the annual trouble cost per switch is about $3 per switch. If the switches are not provided with lightning protection and the trouble analysis shows that 4.5 failures per 1,000 are due to lightning, then an annual charge not exceeding $1.50 per year per switch would be the maximum that could be economically spent to eliminate the lightning failures. If the average cost of full protection is set at $30, with 15 per cent carrying charges, the yearly cost would be $4.50 per switch, thus indicating that no matter how efficient the arrester in preventing switch failures, general application of this equipment to pole-top switches would be unwarranted economically. An extension of the analysis, on the other hand, might show that it would pay to spend $15 a year to protect tie switches to do away with all lightning troubles there, or $11.25 per tie switch if arresters are 75% effective.

Before putting into effect the conclusion that arresters should be installed at all tie switches, however, all other means of attaining the desired result should be examined, since it might be found that the use of an improved switch or some other alternative disconnecting device might yield an even greater saving.

The statistical record greatly aids in controlling engineering outlays, notably in the face of complaints arising from important customers suffering from rare interruptions. These may sometimes be required to prevent loss of business, but their guidance is helpful at all times. Trouble analysis consists in judging the relative importance of outage incidence in relation to system design changes and operating procedures, such as periodic testing of transmission lines which have an excellent service continuity record. It provides a check on system safety factors and contributes toward the maintenance of good public relations, as well as tending to reduce the cost of public relations works resulting from customer dissatisfaction arising from outages. The evaluation of customer service outages is an important phase of the general problem of establishing correct system economics, which will be discussed in a later issue of ELECTRICAL WORLD.

Table II—Economic Study of Three Methods of Reducing Line Troubles*

Estimated Reductions from Correctives	Correctives: Application of Improved Line Wire In (a) Alternate Pin Positions	(b) All Pin Positions	(c) Use of Double Wire Spacing Where Space is Available
1. In tree troubles causing outage, per cent	45	55	20
2. Expected from Table I (now 12 outages)	5.4	6.6	2.4
3. Saving per M. miles wire per year (outage +repairs=$100 per trouble)	$540.00	$660.00	$240.00
4. In tree troubles not causing outage, per cent	70	80	50
5. In trouble rate (now 8 outages)	5.6	6.4	4.0
6. Saving per M. miles wire per year (repair cost=$8 per trouble)	$45.00	$50.00	$30.00
7. In wire troubles causing outage, per cent	55	65	20
8. In trouble rate (now 20 outages)	9.9	11.7	3.6
9. Saving per M. miles of wire per year (outage+repairs=$115 per trouble)	$1,140.00	$1,350.00	$414.00
10. In wire troubles not causing outage, per cent	75	85	50
11. In non-outage trouble rate	2.3	2.6	1.5
12. Saving per M. miles of wire per year (repair cost=$6 per trouble)	$14.00	$16.00	$9.00
13. Total annual savings per M. miles primary (Items 3+6+9+12)	$1,740.00	$2,080.00	$690.00
14. Cost of correctives per M. miles wire			
(a) On new plant only	$3,900.00	$15,500.00	0
Annual charges	$350.00	$1,400.00	0
(b) In existing plant	$14,300.00	$57,200.00	$1,300.00
Annual charges	$1,290.00	$5,150.00	$80.00
15. Net annual saving per M. miles primary			
(a) On new plant only	$1,390.00	$680.00	$690.00
(b) In existing plant	$450.00	Loss	$610.00
16. Annual profit on corrective			
(a) On new plant, per cent	33	4	Unlimited
(b) On existing plant, per cent	3	Loss	47

* This study is intended to demonstrate the utility of the method only and should not be construed as proving the relative merits of the methods of line construction named.

Motor-Driven Booster Supplies High-Pressure Steam

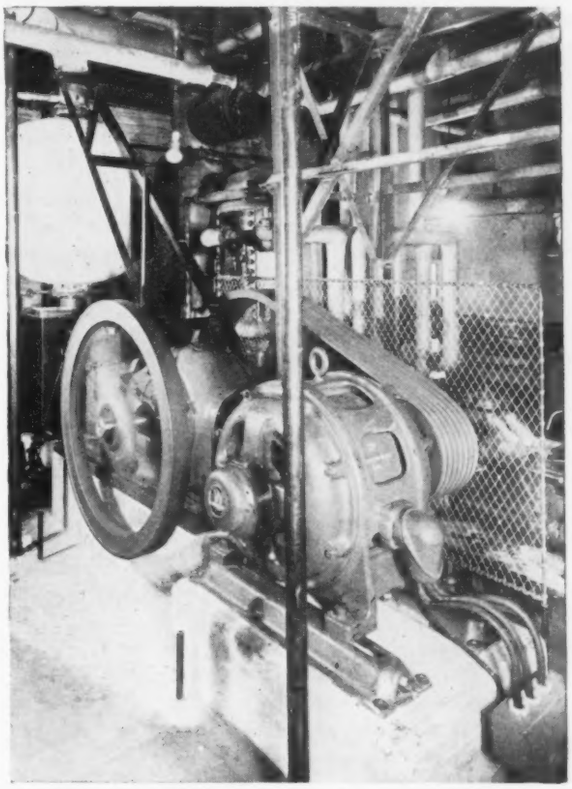
By ARTHUR D. LEACH
Superintendent Steam Department, Northwestern Electrical Company, Portland, Ore.

EARLY in 1937 the 600-room Multnomah Hotel of Portland, Ore., negotiated a contract with the Northwestern Electric Company whereby the company agreed to supply all steam (high and low pressure) and all electric energy, formerly produced in the hotel's isolated plant, consisting of three 150-hp., 150-lb. pressure boilers and two engine-driven electric generators having a total capacity of 300 kw. Standby electric service had been supplied by a local utility.

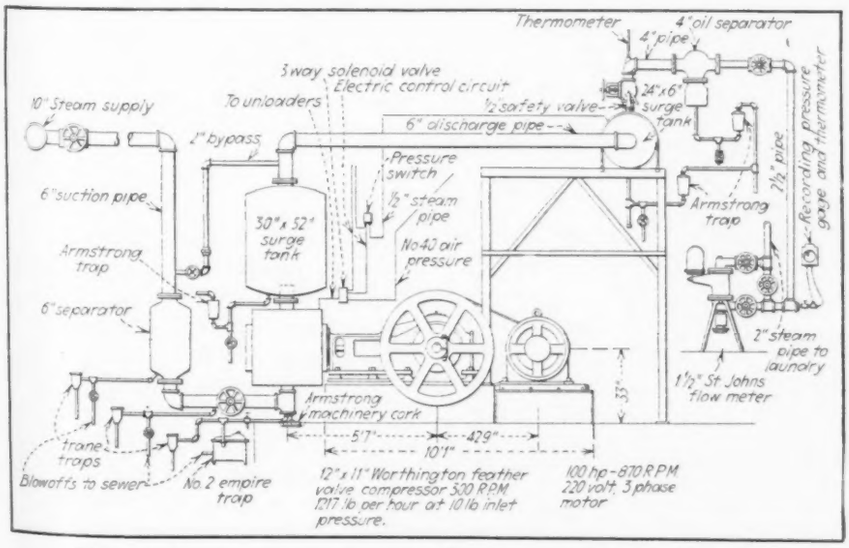
The change from generated to purchased electric service offered no unusual problem, nor was any difficulty anticipated or experienced in substituting the company's low-pressure (12-lb.) steam for all heating, water heating and kitchen requirements, although it had been the practice to supply all kitchen equipment with 40-lb. steam. However, special provision had to be made in order that the laundry machinery, located in the basement, and two clothes-pressing machines, located on the eighth floor of the hotel, could be supplied with steam at 85 lb.

Several alternatives, including (1) constructing a high-pressure steam main from the company's nearest station to the hotel; (2) the firing of one of the existing boilers or installing a smaller flame - fired boiler, and (3) the installation of one or more electric boilers, were duly considered and rejected by the hotel management or the company as not suitable or economical in this particular case.

The average and maximum hourly high-pressure steam requirement of the two departments of the hotel having been determined as being 850 and 1,100 lb. per hour respectively, it was mutually agreed after a thorough investigation that an attempt would be made to supply this service by compressing company-supplied steam from 12 to 85 lb. or other pressures as needed or desired. Accordingly, a 12x11-in., 300-r.p.m. steam booster compressor was purchased and installed in the somewhat crowded basement of the hotel. The compressor is driven through seven V-belts by a 100-hp., 870-r.p.m., 220-volt, three-phase motor. Both motor and compressor are mounted on a concrete base pier which rests upon the concrete foundation mat of the building 18 in. below the basement floor level. In the interest of operating economy, the compressor was equipped with an automatic adjustable unloader actuated by compressed air of 40 lb. pressure and designed to maintain a constant discharge steam pressure. Approxi-



Installation in Multnomah Hotel permitted purchased power to supplant isolated plant



Motor-driven compressor converts 12-lb. steam to 85 lb. with noise and vibration eliminated

mately 85 per cent of the current required at full loading of the machine is saved when the unloader valve is open.

The compressor unit, which is 25 per cent over-powered, has performed as guaranteed and as anticipated excepting that the noise produced during the compression stroke proved objectionable to the hotel management. It was determined, by the use of a crystal microphone properly insulated from air vibrations, that this deep-toned vibration, resembling the noise produced by distant or muffled compressed air drills, was communicated to the building structure through the foundation piers and transmitted to upper floors in the section of the building above the machine.

Unfortunately the machine foundation had not been isolated from the reinforced concrete building structure and could not be so treated without unusual expense and the serious interruption of the operating schedule established by the hotel after discontinuing the use of its boilers.

To relieve the situation, a supplementary 30x52-in. steel expansion tank was installed at the discharge of the compressor, all piping, including the original 24x60-in. expansion tank, was removed from contact with the building and all supports were isolated from the structure by the use of building cork. Although this change eliminated perceptible vibration and reduced noise, it was not until the compressor was mounted on a 2-in. layer of building cork and completely isolated from all anchor bolts and nuts, by means of short pieces of rubber hose in the case of the former and cork in the latter, that the noise was reduced to a satisfactory minimum. In future similar installations the foundation block will be isolated from the building structure with a generous bed of building cork or by one of the proprietary vibration-damping materials.

General features of the installation, including the method used in eliminating noise and vibration, are shown in an accompanying illustration. Attention is directed to the large number of traps used to drain the system as a precaution against the collection of condensate in the compressor cylinder.

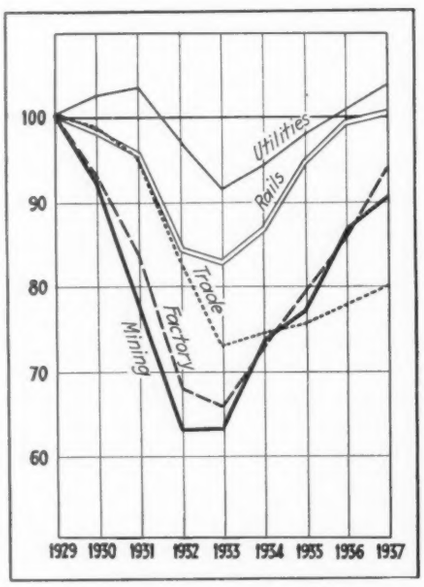
At the inlet of the compressor the condition of steam which is supplied directly from the company's mains is as follows: Pressure, 12 lb.; temperature, 250 deg. F.; B.t.u. per pound, 1,165; degrees superheat, 6. After compression to 87 lb., the temperature is increased to 395 deg., the B.t.u. per pound increased to 1,223 and the superheat content raised to 66 deg. The compressed product is obviously of a higher quality than dry saturated steam ordinarily obtained from boilers without superheaters, even though much of the superheat is lost through radiation from the insulated piping before delivery is made to the laundry machinery. Incidentally, steam temperatures at the compressor discharge are considerably greater than those recorded on the gauges, which are about 30 ft. downstream from the machine and record temperatures after steam has passed through intervening piping and two large expansion tanks.

In this particular installation the cost of compressed steam, including the cost of electricity used in compression, is fully competitive with any other practicable means of developing the supply.

Utility Wages at New High Level

WAGES of utility employees decreased less during the early years of the depression than those of other large groups of employees and they have made a better recovery. The chart, here reproduced from the Cleveland Trust Company *Business Bulletin*, brings out the comparison. Taking the average annual pay in 1929 as 100 in each case, that of the utility employees actually increased in the first two years, and then, after a moderate decline to 1933, recovered until it is now a new all-time high level. The next most favorable showing is that of the railroad employees. Their pay declined until, in 1933, it was some 17 per cent below the 1929 level, but since then it also has advanced to new high levels, a little above those of eight years ago.

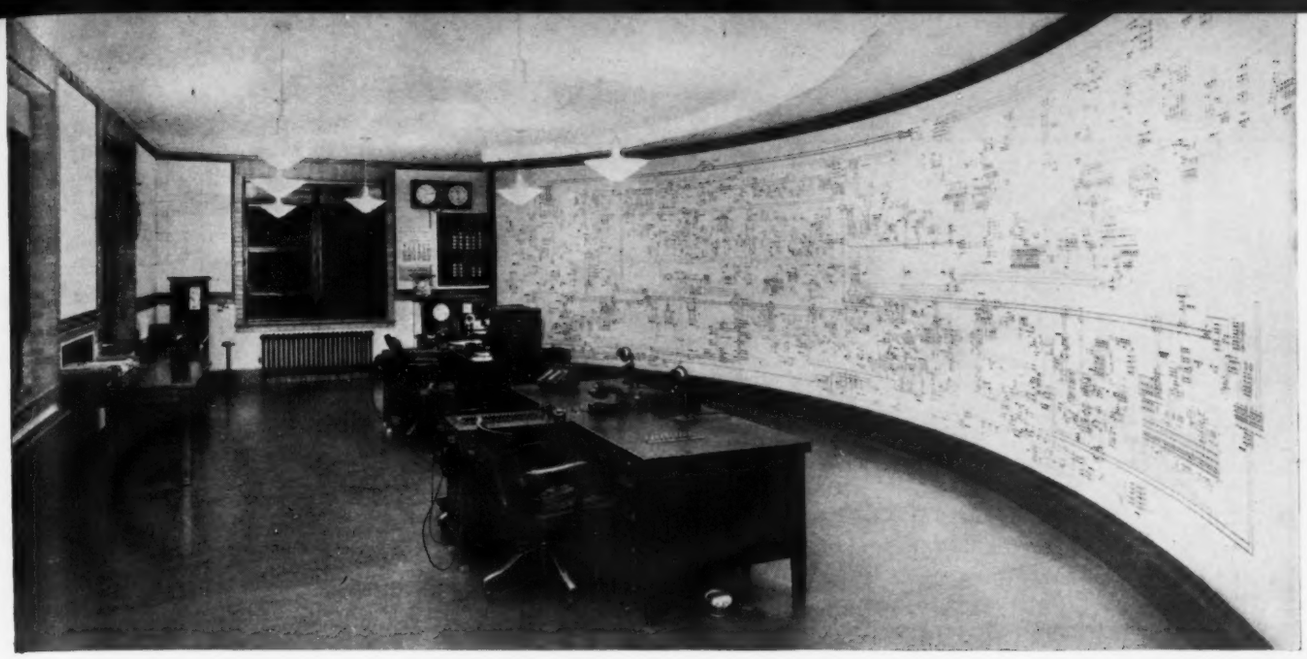
Factory workers and miners suffered most. In 1933 the pay of the typical employed factory worker was about 34 per cent below the 1929 level, while that of the average working miner was 37 per cent below. The pay of factory workers now is only 6 per cent under the 1929 level, while that of the miner is 9 per cent below.



Pay per employed worker
Average 1929 = 100

Wages of workers employed in wholesale and retail trade declined during the depression much less than did those of the factory workers and miners, but their recovery since 1933 has also been much smaller. They are still some 20 per cent lower than they were in 1929.

The figures used in these comparisons, except those for railroad workers, are derived from the employment indexes and the payroll indexes compiled by the Bureau of Labor Statistics of the Department of Labor. They probably reflect with approximate accuracy the changes in the per capita wages of the employed workers, but they are not reduced to the equivalent of pay for full-time work.



Even illumination aids use of dispatch board

Better Light for System Dispatchers

New England Power Operating Center Takes Prescription of Illuminating Engineering and Improves Seeing Conditions — Higher Intensities Without Glare

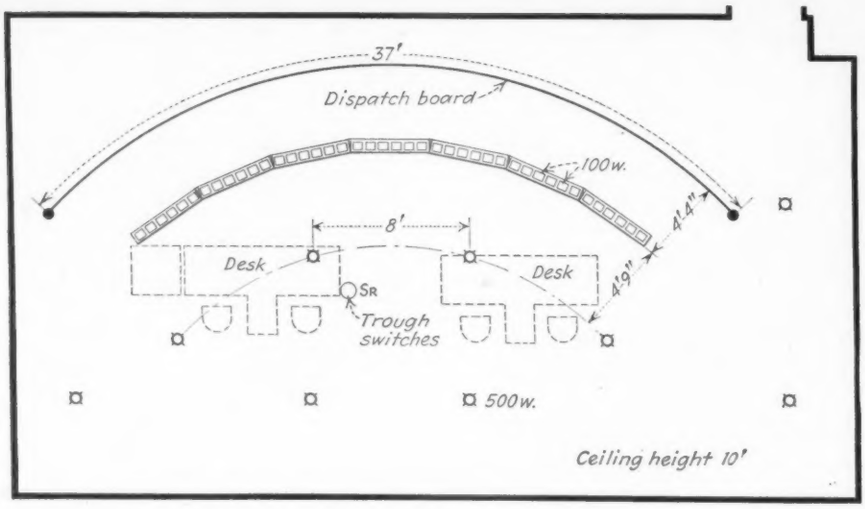
By W. S. MOWRY
Worcester (Mass.) Electric Light Company

IN THE dispatching room at New England Power's Millbury, Mass., operating center, where the key control to this utility group's far-flung net work of high-tension wires, substations, hydro and steam plants and interconnections is centered, major improvements in lighting recently have been completed. Formerly the dispatching room was lighted by a semi-indirect system of 300-watt lamps on 8.5 x 10-ft. spacings, with a delivery capacity of 8 to 10 ft.-candles. Because of the insufficiency of this intensity, bad reflections and direct glare from lighting units, the corps of dispatchers was subjected to considerable eye fatigue. The effectiveness of the indirect portion of the illumination was also minimized by the poor ceiling reflection resulting from the ivory-colored, perforated metal acoustic tile and the deterioration of the painted surface itself.

The eyestrain encountered under those conditions may be best realized by the situation near the curved dispatch board. This board, 37 ft. long x 10 ft. high, was dependent solely upon the general lighting of the room for illumination. When tested, the illumination measured only 4 to 5 ft.-candles at a point where the seeing task paralleled that of seeing one-quarter inch type at a distance of 12 ft.

To relieve unnecessary eyestrain, it was obvious that a complete relighting and painting job and the installation of a separate system for the board were necessary. Visibility meter tests showed that a very high level of illumination was needed; illumination which would enable the dispatchers to see easily without fatigue from the light diffusely reflected toward them from large areas of the board.

The board is finished in a matte gray-white with a reflection factor of approximately 60 per cent. The circuit diagrams are in lines of various colors, with black symbols. Colored glass-headed pins which indicate switch positions throughout the entire system stud the entire area. Many other seeing problems were involved, such as colors, pin contrasts on colored lines, familiarity of operators with the diagrams, incident angle of light, color correction of the light source, desirability of varying illumination intensities as the operators' work changed. But in spite of these the major problem was to determine the maximum allowable illumination without introducing objectionable reflected glare from the board.



Layout of lighting units in operating room

Bright afternoon sky illumination on the board varied from 23 ft.-candles at the top to 60 ft.-candles at the bottom, and it was apparent that at such a period additional light on the upper part of the board would be desirable.

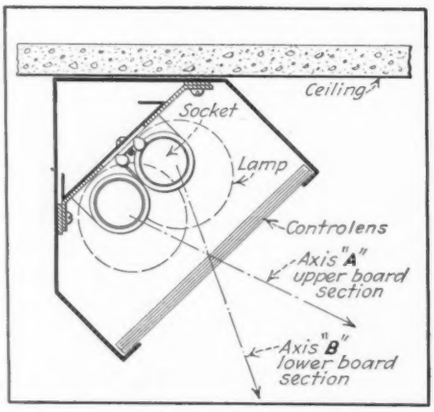
Before building a piece of experimental equipment, every possibility was exhausted in trying to design a recessed system and eliminate a portion of the heat input. The 16-in. square sections of tile were supported by slotted tee-iron strips. Above these were 3 x 4-in. supports, running between large steel beams. A sufficient number of clear openings, symmetrically located in relation to the board, could not be found, so a continuous exposed trough was decided upon. Because a prismatic lens could be used to direct light more efficiently than a bare lamp, a trial section of such a trough was installed.

This lighting was first operated at 4 watts per sq.ft. of board, giving a maximum value of 24 ft.-candles and an average of 19 ft.-candles. After observations were made over a reasonable period, the lighting was increased to an equivalent of 8 watts per sq.ft., with a maximum of 34 ft.-candles and an average of 27. When completed, the effect of a continuous section would be to increase these values, while a more even distribution of the final equipment would tend to decrease the maximum readings. As a solution, it was decided to design the final installation for 30 to 50 ft.-candles.

A mitered "Litecontrol" trough consisting of seven 4-ft. sections was installed, with 100-watt horizontal lamps every 8 in. These were alternately positioned in relation to the axes of 6.5-in. prismatic plates to distribute the beams to the upper and lower areas of the board. The trough was mounted along an arc 4 ft. away from the board, with the plates at such an angle as to be invisible from the desks. The wattage capacity is 1.2 watts per sq.ft. of board area, and test readings indicate it will deliver, after a 25 per cent depreciation, a maximum of 45 ft.-candles and an average of 40 ft.-candles. To simplify calculations and also because the light was falling on a matte surface, all values given are foot-candles normal to the source.

Adjustable intensities required

It was deemed imperative that the dispatchers be given a flexible method of operating this system. Afternoon operation might call for only upper board illumination, emergency conditions for maximum light and quiet night hours for only one-half or one-third illumination. To afford this flexibility, the wiring specifications provided for four circuits, so switched



Cross-section of dispatch board reflector

that every fourth lens or every second lens could be used for the upper board. Half illumination can also be selected by turning on alternate upper lenses and alternate lower lenses, or, in other words, alternate pairs. The station service is two-wire, and switches within easy reach of a dispatcher operate the circuits through small range-type contactors compactly ganged with the circuit fuses in a small cabinet at the rear of the board.

As to the general lighting, a system of ordinary design would not fulfill the needs because of the varying ceiling brightnesses near the curved board and in the visual angle of the dispatchers. To counteract this, an equidistant arrangement of ceiling outlets was planned for all lighting units next to the board. If units were placed too close the ceiling near the board would receive more light, but uncomfortable ceiling brightness immediately above the fixtures would come in the visual range. If units were too far from the board the brightness difference between the board and ceiling would increase greatly. This row of outlets was thus planned to bring the lines of cutoff along the dark wood border, delivering all the output to the ceiling on the assumption that the light reflected from the board would assist in minimizing brightness differences.

A translucent indirect fixture of very low brightness was chosen further to minimize brightness differences.

The general lighting system as installed consists of 500-watt Ainsworth-"Magna" fixtures spaced approximately 8 ft. apart, on a 10-ft. ceiling, with an over-all suspension of 32 in. Wherever old outlets were discontinued whole tile squares were substituted. The ceiling was painted a flat white and care was taken not to close up any of the perforations which might alter the acoustics. Illumination on the desks after depreciation will be at a minimum of 25 ft.-candles.

The results of this new installation demonstrate the strides made in the solving of difficult lighting problems in the last few years. With modern illuminating practices, no inadequate lighting job appears too difficult for solution. The dispatching room at this important center stands as an illustration of the transformation possible under "the science of light in seeing."

Slide Rule Yields Lamp Flicker Data

Pocket Rule Indicates Thresholds of Flicker Objection and Perception — Yields Voltage Data for Analysis of Flicker Problems and Complaints

By C. P. XENIS . . . W. PERINE
Consolidated Edison Company of New York, Inc.

WITH the widespread use of electrical distribution systems supplying both light and power loads, the problem of lamp flicker produced by voltage fluctuations has become a very real one. The operation of welding equipment, the starting of motors and the operation of motor-driven reciprocating equipment on such combined secondary systems will certainly affect the quality of lighting because of voltage variations, unless adequately provided for in design. It is obvious that the expense involved in building a system sufficiently reinforced to *eliminate* flicker is prohibitive, and that a more economic method is to reduce flicker to unobjectionable values. What, then, are "unobjectionable values"? The answer to the question has been found by summarizing and digesting the large amount of experimental data and field experience available in the literature on lamp flicker. This work was a necessary and important preliminary to the development of the lamp flicker slide rule, a device which makes available in handy and convenient form the information so prepared.

It has long been established that human perception of flicker depends fundamentally on the magnitude of the variation in illumination and its frequency of occurrence. The development and use of incandescent lamps changed this fundamental relation only to the extent that voltage variation could be substituted for change in illumination as a variable. Thus for the classical thresholds of perception drawn with illumination variation as a function of frequency of occurrence, similar curves were produced in terms of voltage change and frequency. This relation is subject to modification by a number of other factors. From a practical point of view, however, the experimental data indicate that the major modifying variables are the lamp size and the rate of voltage change. It should be noted that for thermal reasons *the size of lamp affects the voltage-illumination relation only in the region of rapid fluctuations*, extending from the high frequencies down to no lower than one or two dips or variations per second. On the other hand, in the region *where flicker is produced by intermittent dips*, for reasons probably related to eye-response, *it is the rate of voltage change which becomes im-*

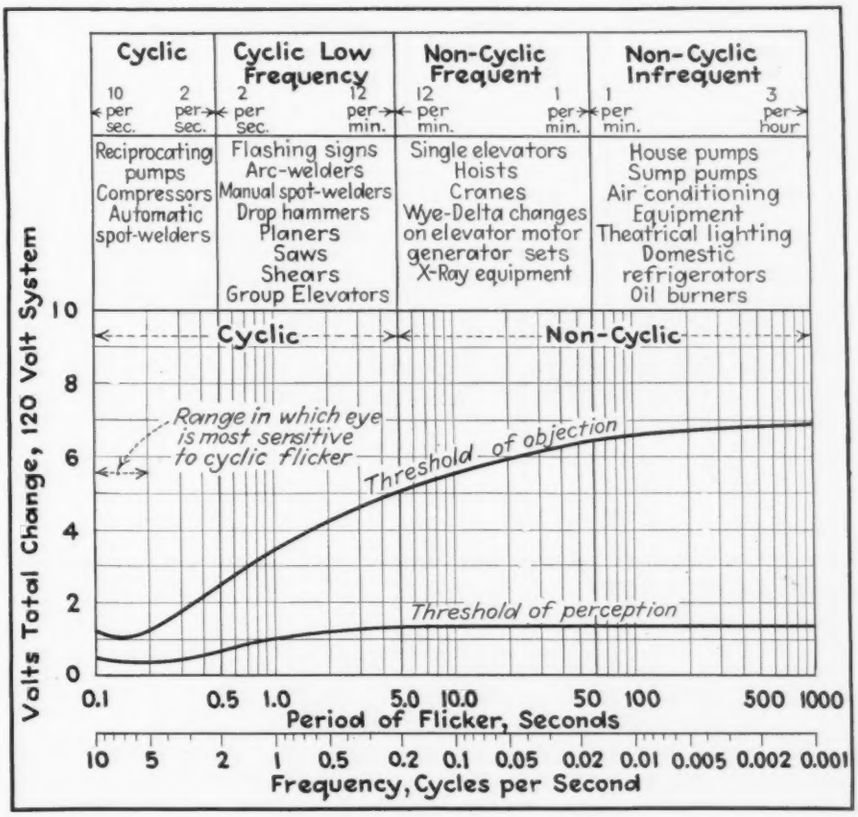


Fig. 1—Curves of voltage variation show lamp flicker perception and objection thresholds

Curves show values of voltage variation that have been found to produce flicker that is just perceptible and that is objectionable. In cyclic region lamp size affects objection, while in non-cyclic region rate of voltage change is important factor.

*portant as a modifying factor rather than the lamp size.**

In assembling the basic data to be incorporated in the slide rule, it was desired to obtain some practical, continuous summarizing relation between perceptible voltage variation and flicker frequency throughout a reasonable, useful range, instead of treating the problem as two separate and distinct parts; *i.e.*, "cyclic flicker" and -"non-cyclic flicker." Werdenberg, an investigator in Zurich, Switzerland, in his work had fortunately explored the "no-man's land" lying between these two parts or zones set up by other investigators. Therefore, it was felt that all the elements were available for the expression of the continuous relation desired. It was decided that a flicker frequency range extending from rapid cyclic variations of 10 cycles per second to infrequent non-cyclic dips which occur about three times per hour was sufficiently broad for practical purposes. Such a range would cover the ordinary run of voltage disturbances from the flicker due to the operation of reciprocating machinery to the starting dips of individual, infrequently operated motors.

After making a preliminary digest of lamp flicker test results and data obtained from operating experience, representative and comparable data as reported by some twenty-one groups of observers were carefully selected and analyzed in order to evaluate and justify the many differences in the minor variables. Because of the very nature of the work, this material represented thousands of individual observations, and therefore a comprehensive mass of data was grouped together in this analysis. Of necessity, such facts as numbers of observers, levels of illumination, wave-shape of voltage variation, condition and disposition of observers, type of lighting, etc., were considered in order properly to weigh and interpret the data available.

Perception and objection thresholds determined

This material falls readily into two general classes—that indicating what values of flicker voltage are just perceptible and that indicating what values are likely to be objectionable. Thus when the summarizing curves were prepared from the data a "Threshold of Perception" was drawn from the "just perceptible" data and a "Threshold of Objection" was drawn from the data for "objectionable" flicker. The two curves shown in Fig. 1 are the thresholds referred to, redrawn for simplicity without indicating all the mass of substantiating data. These curves show the values of voltage variation which will in general produce lamp flicker just perceived by the average person and the values which will produce objectionable flicker in the opinion of a substantial percentage of observers.

It has already been stated that in the cyclic flicker region the lamp size is of importance, and in the non-cyclic region the rate of change of voltage is important. These thresholds should therefore be modified according to these two variables. For example, if when using the curves in the cyclic range it is desired to interpret for the size of lamp, one should pick values slightly above the curve for large lamps or pick values slightly below it for small lamps. Similarly, when

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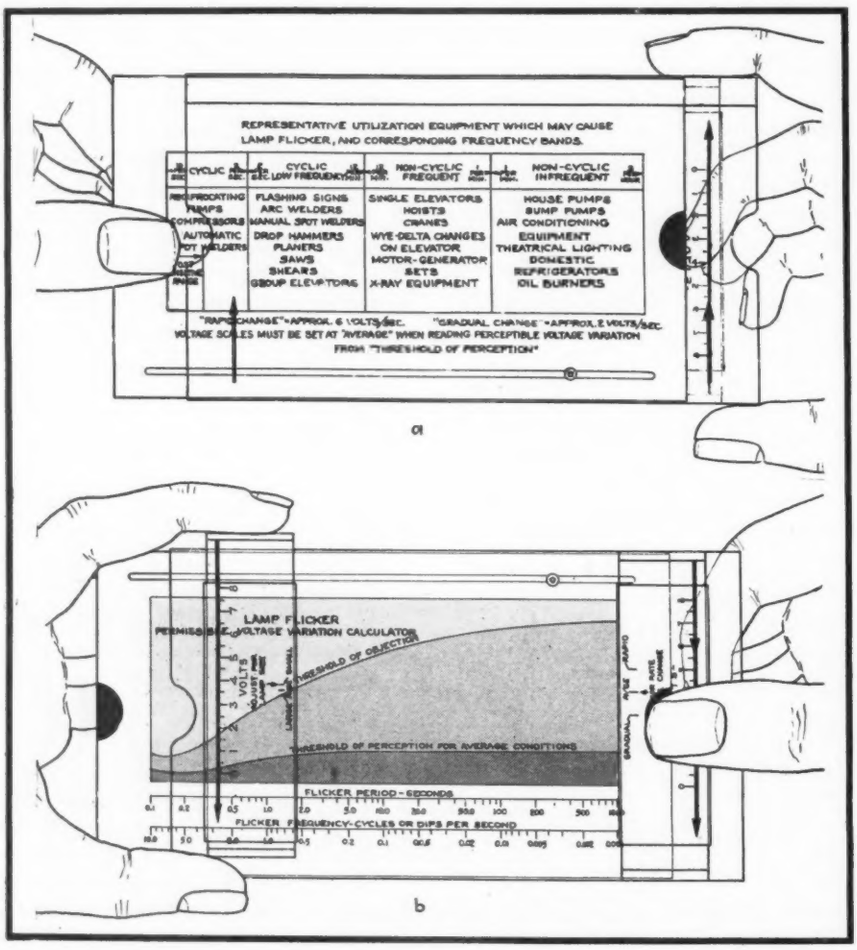


Fig. 2—Slide rule gives voltage variation for perception and objection for different sizes of lamps and rates of voltage change at specific flicker frequencies

(a) Reverse side of rule. Card has been withdrawn to the left side of the envelope. The arrow points into the band called cyclic whose limits are 10 cycles per second and 2 cycles per second. In this band is listed the equipment most likely to cause cyclic flicker of this specific frequency. Other similar bands list equipment likely to cause flicker of other cyclic and non-cyclic frequency ranges.

(b) Face of rule. The specific value of flicker frequency being studied has been set at 2½ cycles per second under the fixed arrow at the left by moving the card in the envelope. It is desired to know the obectionable voltage variation when using small lamps. The vertically adjustable ordinate scale of voltage variation is shifted upward until its arrow points to small lamps. The objectionable voltage variation is found to be 1.7 volts at the point on the voltage scale at which the threshold curve passes under it. Were the lamps considered to be "average" size, the objectionable volts change would be read 1.9 volts and the preceptible volts change (from the "threshold of perception") with the slider set at "average" would read 0.5 volt. If it were required to obtain information for a non-cyclic case, the card need only be moved to the right and the right slider adjusted and read. If, again, a case was to be studied in which the specific value of frequency or period were known the slide rule would be set up from this information and used.

* In preparing a summarizing report entitled "The Perception and Tolerance of Flicker by the Human Eye," the Committee for Project 10, Edison Electric Institute, did commendable work in gathering data from a great many sources and including the results of field and laboratory tests and actual field experience. To name but a few, this report noted the important contributions of such investigators as Lindberg, Kehoe, Ives, Brown, Fisher, Hurd and Phillips, Dow, Reinhardt, Sanford and Weise, together with the findings of a number of electric utility companies.

Hartford Mercury Unit's Record Under 11,000 B.t.u.

NINE YEARS ago this fall the pioneer mercury boiler and turbine installation of the Hartford Electric Light Company's South Meadow generating plant went on the line, following extended experimental operation of this new type of prime mover equipment at Dutch Point station in the same city. Through the courtesy of T. H. Soren, vice-president of the Hartford company, the over-all operating record of this unit down to July 1, 1937, is here made public for the first time. Including fluctuations in service availability due to the newness of this initial commercial development at Hartford, the South Meadow unit has been in operation 47,130 hours during the above period. The year-by-year average performance has been 10,812 B.t.u. per net kilowatt-hour delivered from the start in 1928 to the end of 1936, and the average performance for the first half of 1937 has been 10,512 B.t.u.

South Meadow unit was built by the General Electric Company, following the lines indicated by the engineering researches of William LeRoy Emmet, long consultant of that manufacturer. The outfit is a complete power plant in itself, generating 10,000 kw. in a turbo-generator driven by mercury vapor and 129,000 lb. of steam (at 280 lb. pressure) per hour which is delivered at the steam mains for use in the steam-driven units at this station. The steam is generated in a condenser-boiler, into which the mercury vapor is passed after leaving the turbine, and the principal features of the unit have been widely described in the engineering press. *Per se*, it gives the company roughly 20,000 kw. in electrical capacity when under full load. The mercury is vaporized at about 70 lb. per square inch.

Lowest figure 10,210 B.t.u.

The commercial utility of the unit is indicated by the fact that from its initial service in 1928 through to July 1 of this year it produced a net output of 793,527,540 kw.-hr. The maximum output in any single year has been 129,261,710 kw.-hr. (in 1936). In six of the period years the unit delivered more than 100,000,000 kw.-hr. per year, net, and in the first half of 1937 the production was 54,049,490 kw.-hr. The lowest unit fuel consumption in B.t.u. per kilowatt-hour for any year's record was 10,210 in 1936, and during the present year the minimum B.t.u. per kilowatt-hour net was 10,050 (January, 1937). The highest B.t.u. record for a period year was 11,820 (in 1928).

There is no operator in attendance on the mercury boiler and in operation there is one oiler to each watch in the turbine room. The load is controlled by the boiler room operators on the boiler operating floor.

Operation of the unit in 1928 and 1929 reflected the vicissitudes of initial service for a new development which did not escape trouble. Tube and some other difficulties had to be remedied, but in 1930 the unit produced 121,037,820 kw.-hr. net, indicating its arrival as a power plant mechanism subjected to commercial necessities. In 1931 complete retubing of the boiler became necessary, with new turbine diaphragms and cer-

[*Continued on page 101*]

Table II—Month-by-Month Operation First Half of 1937, South Meadow Mercury Unit

	January	February	March	April	May	June
Lb. oil burned	5,723,076	5 856,359	7 815.833	1,829,478	3,819,011	5,537,807
Lb. steam generated	62,232,000	60,170,000	78.971.000	16,370,000	45,462,000	61,090,000
Kw.-hr. mercury generator	3,924,000	4,188,000	5,806,000	1,156,000	2,417,000	3,894,000
Kw.-hr. from steam	6,461,290	6,323,600	8,308,800	1,588,000	4,266,800	6,337,700
Kw.-hr. net output	10,270,290	10,399,600	13,976,800	2,687,000	6,597,800	10,118,000
Lb. fuel per net kw.-hr.	0.557	0.563	0.559	0.681	0.579	0.547
Total hours' run	737.25	632.75	744	191.50	569.25	657.50
B.t.u. per net kw.-hr.	10,050	10,130	10,062	12,258	10,422	10,150

Table I—Year-by-Year Results of South Meadow Mercury Unit, Hartford Electric Light Company

	1928	1929	1930	1931	1932	1933	1934	1935	1936
Lb. coal burned	4,836,215	9,218,090	86,806,670	9,981,660	62,064,784*	58,276,992*	72,373,320*	68,733,218*	72,502,389*
Lb. steam generated	37,005,000	78,115,000	713,388,000	76,430,000	659,813,000	626,340,000	744,090,000	725,702,000	746,988,000
Kw.-hr. mercury generator	2,917,750	5,612,000	52,460,000	5,378,000	49,407,000	44,507,000	51,773,000	49,190,000	52,725,000
Kw.-hr. from steam	2,961,470	6,417,550	70,981,260	7,643,000	62,396,260	59,522,220	74,254,943	74,642,200	78,065,000
Kw.-hr. net output	5,718,470	11,676,480	121,037,820	12,699,760	110,223,450	102,477,980	124,283,533	122,096,850	129,261,710
Lb. fuel per net kw.-hr.	0.8457	0.7895	0.7172	0.7828	0.5630	0.5687	0.582	0.563	0.561
Total hours' run	429.25	993.16	6,157	650.75	6,515.5	6.753	7.596	7,211.75	7,291.5
B.t.u. per net kw.-hr.	11,820	11,265	10,340	11,340	10,562	10,635	10,889	10,250	10,210

*Fuel oil burned, in pounds.

Cutler-Hammer Controls

Fitting Control Equipment to Conveyor Machinery—I

By GEORGE H. HALL
Consulting Engineer, Douglaston, N. Y.

FOR THE operation of conveying machinery it is most desirable that the control equipment, employed with the motors by which the conveyors are driven, shall be of the least complicated type that is consistent with the character of the work which they are to perform, but that such control equipment, in addition to its basic function of starting and stopping the motor, shall provide all necessary protection against overloads, accidents and, in many cases, against operation out of desired sequence.

In but few applications of motor equipment to conveying machinery is speed control required, other than that involved in gradual starting, so that the consideration of the control equipment for nearly all types of conveyors may be based upon employment with constant-speed motors for starting and stopping and, in some instances, for reversing the direction of motor rotation. This latter function, reversing operation, is seldom required in connection with conveyors except in some few cases where conveyors which are used to carry material from a receiving platform to a warehouse may at other times be used for bringing material back from the warehouse to the platform for delivery. Such instances are, however, of sufficient rarity to be considered as more or less special. For the majority of conveyor applications the function of the control is simply that of starting and stopping the motor.

Motor starting

Such types of conveyors as are employed for no-load starting are generally equipped with squirrel-cage motors of the type designed for low starting current, and for many conveyors which are started loaded, or partially loaded, ample starting torque is provided by the use of a squirrel-cage motor having a high-resistance winding, which affords heavy starting torque and at the same time retains the low starting-current characteristics. Both of these types of motors may be started by connection directly across the line provided the conveyor will stand the camparatively sudden shock of rapid acceleration. The limiting capacity of motors that may be thus started is determined by the maximum size which the local power companies will approve for throwing directly upon their lines. This limit usually lies between 30 and 50 hp.

When the construction of the conveyor is such that it is inadvisable to subject it to the shock of full starting torque a primary resistor starter may be used, by which the motor is first subjected to about 65 per cent of the line voltage. By the use of a timing mechanism this reduced voltage is applied for a predetermined time, after which the resistance is automatically

cut out of the circuit and the motor connected directly across the line. Since the motor, when used with this type of starter, is first subjected to a reduced voltage, the starting torque is likewise reduced. If the motor does not start the conveyor on the first point it will have taken the backlash out of the gears and the slack out of the belts, so that the resulting shock to the machine when full voltage is applied will be less than when the motor is thrown directly onto the line.

Across-the-line, alternating-current starters, which are used with a large proportion of conveyor motors, are virtually nothing but magnetic switches provided with suitable low-, or under-voltage and overload protection. Such starters are actuated by momentary contact, start and stop push buttons.

The foregoing applies, of course, to alternating-current motor equipment, since direct-current motors, above 2 or 3 hp., must be started by some type of resistance starter. The use of direct current for industrial purposes is now very limited and is found mainly in plants which operate their own generating stations.

Motor protection

Overload protection is usually provided by the use of thermal overload devices which, while permitting rather heavy starting currents of short duration, will effectively stop the motor when it is subjected to overloads which are sufficiently long sustained to damage the motor if permitted to continue.

Low- or under-voltage protection is attained by the suitable connection of the magnet by which the switch is closed and retained in closed position.

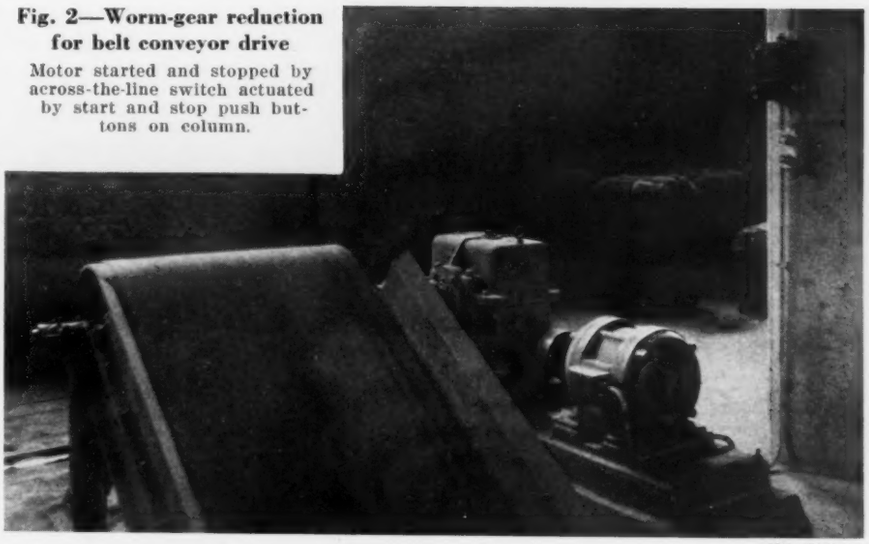
When the start button is depressed this magnet is energized and causes the switch to close, thus placing the motor on the line. As the switch closes, a secondary contactor also closes and establishes a circuit from the line directly through the magnet so that the release of the push button does not interrupt the holding circuit. Depression of the stop button, or operation of the thermal overload devices, breaks this holding circuit, thus de-energizing the magnet and allowing the switch to open and the motor to stop. This provides under-voltage protection since, when the current through the holding coil has been broken, the switch having opened will re-establish motor connection only upon intentional depression of the starting button.

For direct-current motors on conveyors starting is generally effected by the use of manually operated resist-

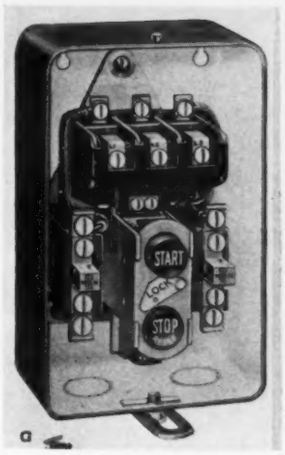
[*Continued on page 104*]

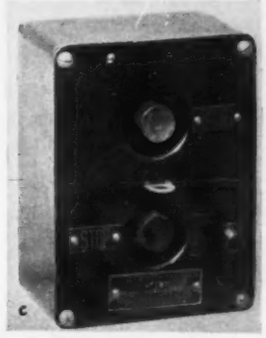
Fig. 2—Worm-gear reduction for belt conveyor drive

Motor started and stopped by across-the-line switch actuated by start and stop push buttons on column.



Allis-Chalmers





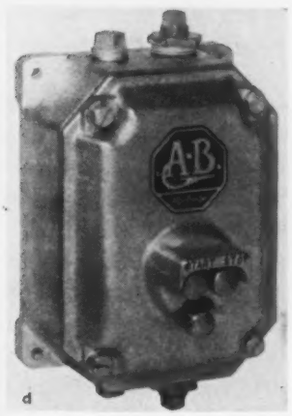
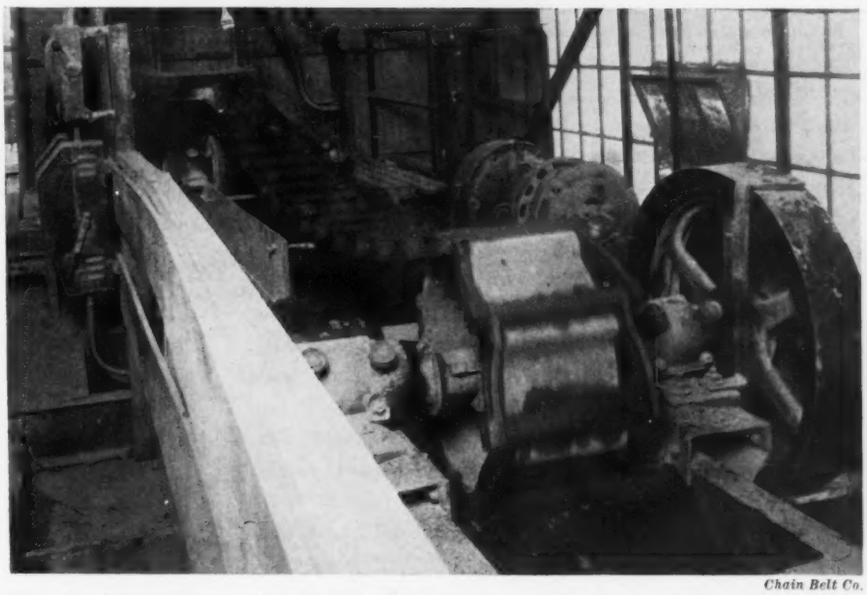


Fig. 3—Types of push-button stations

(a) For general use (Allen-Bradley); (b) emergency stop button (G. E.); (c) padlocked so motor cannot be started when stop button is locked open (G. E.); (d) for use in hazardous locations (Allen-Bradley).



Chain Belt Co.

Fig. 4—Compensator starter controls motor on dinker conveyor. Line switch mounted directly above compensator

Editorials

A PWA Chicken Comes Home to Roost

IT IS becoming more apparent that after all these years Thomas A. Edison was correct in his long-ago assertion that government could not succeed in business. As the record unfolds, it is becoming more apparent that the government may fail of success in the power business.

Latest evidence that something is wrong comes from the little city of Point Pleasant, W. Va., where, this time, the Public Works Administration scents trouble to the extent that it has filed its first suit against a municipality to collect payment on bonds which according to PWA opinion are being unnecessarily defaulted.

Although other suits of a similar nature are being contemplated by PWA, it would be premature at this time to assume PWA is facing a series of defaults on the part of municipalities, which defaults were not expected to materialize until the tide of general business began to recede.

Nevertheless, when a city ignores its financial obligations to PWA, even though, as PWA alleges, it is capable of meeting those obligations, perhaps after all the inexorable laws of economics operate on PWA projects just as they do on projects inspired by private individual enterprise.

It seems only yesterday that municipalities all over the land were filing applications with their respective state PWA directors for duplicate and unnecessary electric plants and systems, competitive gas systems, and a variety of projects which the individual cities did not consider worthy of their own funds. However, when PWA came along and offered to donate from 30 to 45 per cent of the cost of a project, all manner of borderline projects were resurrected and brought to the front doorstep of PWA.

That too many of them had no economic justification was obvious from the applications. That now a municipality won't pay for its projects, even when one-third to one-half of the cost was a donation, is precisely what many interested parties suspected would happen.

With TVA losing money on every kilowatt-hour it sells, with government hydro projects being opened with no market for their output, and now with municipalities telling PWA that it can, but won't, pay interest on its bonds, there would appear indeed to be ample evidence—if any were still needed—that as far as the power business is concerned government is still unable to do the job.

•

Time to Think About Rate Increases?

WHILE this may be no time to raise rates, it may be an excellent time to think about it. In fact, not a few utility executives are now giving considerable thought to the subject.

Wages and salaries are up and are bound to go higher. Coal costs more. Equipment has risen in price. Money is not as cheap as it was a year ago. Taxes will in all probability be higher.

Rates not only cannot continue forever to be reduced under increasing costs of operation, but there can easily come a time when they may have to be increased. How shall these higher costs, over which the utility has no control, be passed on to the customer? Merely to raise rates so as to cover these higher costs might not be to the utility's advantage. On the other hand, to keep the rate unchanged and merely add to the bill a coal charge or tax charge has its drawbacks from the standpoint of costs and customer reaction.

If by some good fortune the occasion for higher rates does not arise no harm will have been done by being ready, but if an upward rate revision becomes necessary it will be much easier to put into effect quickly if the problem has been thrashed out long ahead of time.

•

More Data Needed on Steam Condensation

THE steam condenser forms one of the elements in a modern power plant upon which further development can be expected with resultant gains in plant economy and operation.

Our earliest condensers were usually of the jet type with reciprocating engines, although surface condensers were used at sea. High vacuum was not desirable in such condensers. When steam turbines were introduced, similar types of condensers were used, and in the early years high vacuum was not considered necessary, nor was it attainable with the equipment at hand. When the desirability of high vacuum for steam turbines was recognized inventors turned their attention to the surface condenser. Theories of their action were evolved and new arrangements of condensing surfaces were developed, together with novel forms of

pumps, ejectors, etc. Substantial progress was made in condenser design and many condensers today have established creditable records of performance. Many of the older condensers are being modified in line with later designs in order to get better vacuum and a more efficient use of the cooling water.

But do we really know the controlling factors in ideal condenser design? One has only to attend a meeting of engineers where surface condensers are under discussion to note the great divergences of opinion on steam distribution, tube arrangements, fastenings and supports, reheating of condensate. pressure drop across tubes and supply of cooling water. The laws governing the pressure drop of condensing steam when flowing across tubes are not well established. Possibly there is no direct law due to cross-flows of the condensing medium. Again, are cross-flows desirable or should the condenser be designed in compartments to prevent such cross-flows? Americans favor single-pass condensers, while British practice employs two or more passes. Which system leads to the development of station output at the lowest total cost? Several new and odd forms of condensers are said to be under construction, which indicates that the ideal design is not yet at hand.

Apparently fundamental data upon the condensation of steam in vacuum by cold tubes are needed. Here is a fruitful field for experiment, though the difficulties of such work are many. Until such facts are established condenser design will necessarily embody ideas peculiar to the individual designers.

•

Commercial Load Promotion a Natural

IT IS with considerable interest that we note that attention is now being turned by the utility industry to promotion of the commercial load. First it was the commercial lighting activity sponsored by E.E.I., and now comes the newly organized Commercial Electric Cooking Council.

While the commercial load has never been wholly neglected, it has not received the same attention or prominence as either the residential or the industrial market. Although commercial sales are only one-third of industrial sales, they nevertheless exceed the residential, have a stability second only to the residential, a fairly good rate and enjoy a much higher average usage than the residential.

Like the residential, the commercial classification has its low-use, non-profitable customers, but a survey by the Philadelphia Electric Company shows that 65 per cent of these customers can be brought into the profit group through the use of 75 kw.-hr. or less.

In these days, when the job is not how many kilowatt-hours can be sold, but how many can be sold at a price that brings a fair return on the investment, promotion of the commercial market looks like a natural.

•

REA Turns Its Eyes Toward Load Building

YEARS ago, in one of the coal mining regions, an employer who believed his people wanted better living conditions built for them several houses with bathtubs. To his amazement he found the tenants using the bathtubs as coalbins.

This case is parallel to that of rural lines. The government cried out that the poor farmers had been deprived of electric service by the grasping power companies, and so REA built lines. But, apparently the farmer hasn't been in any hurry to use a lot of electricity. And so now the government, having learned that you can lead a horse to water, but you cannot make him drink, is following the lead of the utilities, in that this month REA is placing in operation six "field-utilization units" to sponsor "load building" on REA rural lines in some 38 states.

A crew consisting of a utilization representative, an agricultural electrification specialist and a home electrification specialist will work anywhere from three to seven states operating from the time REA funds are allotted until the REA loan is repaid.

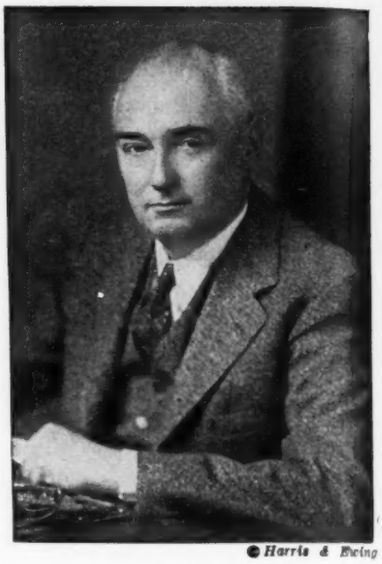
The step is perfectly logical, and considering results apparently is urgently necessary. But more than that, again the government is tearing a leaf out of the utility industry book. Even a plan book—a portfolio on first steps in load building—has been prepared, and again the question is raised as to whether the service companies in the utility industry were and are performing reprehensible duties after all when the government itself now patterns its organization along the same lines.

The operating policies adopted by utility companies in construction, operation and load building are no mere whimsy. They have come from years of bedrock experience with the stubborn facts faced by utility management. Nowhere has the best solution of a management problem been more difficult to find than in the riddle of rural service.

Perhaps it may not be too much to expect that out of such developments there will come in Washington a new understanding of the practical limits which at present circumscribe rural electrification and a new appreciation of the fact that in view of these limits the utility industry has perhaps done a very good rural electrification job after all.

Freight Trips Up Utopian Dream

By CARTER FIELD



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This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

A FARMER out in western Montana was talking to President Harding. It was in 1923. There was a farm problem, of course. But the 1920 price dip was over. Conditions were good, better than normal. The farmer was operating an irrigated farm, much of the cost of which was virtually a government subsidy.

Yet he complained bitterly. He produced figures to show that he just couldn't make a living. Something was wrong. Going over all the figures, the President could only find one which seemed out of line. It was the freight rate.

That farmer was raising Irish potatoes. He was shipping them to Chicago, more than a thousand miles away, over the main mountain range of this continent.

Harding knew that the railroads were far from being prosperous. At the moment they were still struggling to get out of the financial mess wartime government operation had left them in. And he knew no farmer likes to be told that he is foolish in raising the crops he does instead of something else. Farmers are independent that way.

But the Roosevelt dream of a new era, in which the United States will be turned into a sort of Utopia, aims to correct that problem. It embraces a considerable shifting of population. He made it clear on his recent Western trip, as indeed he has many times before, that factories and mills should be transplanted to the West, away from the thickly congested areas of the Northeast. These would consume the electric power to be generated at Bonneville, at Grand Coulee, and incidentally, though he did not mention them, those river developments in Nebraska, pushed through a reluctant Congress against the written opinion of cold-hearted army engineers.

So that Montana farmer, and his neighbors, will have potato eaters brought right to their doors, so to speak, and the freight rate problem which has been making so much unhappiness will disappear.

Two things are wrong with this picture. One is human nature. People don't like to move. Especially the people who *ought* to move. Mrs. Roosevelt and Rex Tugwell found that out with their resettlement projects.

The other thing is freight rates. It cost too much to haul the potatoes to market. It will cost too much to haul the products of those mythical factories and mills which are to consume the Bonneville power to where the people are. Unless, of course, there should be a totally unexpected migration.

Mrs. Roosevelt doesn't expect it. Not now. She did once. She found that the most distressing conditions existed around some closed-down coal mines. So she planned model villages, with factories to occupy the men part time, gardens, homework for the women of a profitable sort, etc. Theoretically it was fine. But the folks didn't like it. The coal miners wanted to go on being coal miners.

But assuming a manufacturer would take a chance on the migration following him out West, so he wouldn't have to pay for a 2,000-mile haul of his product, what would be the incentive?

That's easy, say the New Dealers. Cheap power.

An Eastern utility man was talking with an engineer army officer.

"You know your rates are absurd," said the officer. "We can produce power at the Washington Navy Yard at a fraction of what you are charging per kilowatt-hour."

"Listen," said the utility man. "If you gave us the current for nothing we couldn't reduce our rates. We are producing current from bituminous coal, right in Washington, and it only costs us 3 mills!"

It just happens that the army engineers do not figure current will be produced that cheaply at any one of the big Western projects, even allowing 45 per cent government outright grant, and the remainder at lower interest rates than most private concerns could obtain.

Lots of folks don't know it, but a tremendous quantity of power is produced by burning anthracite. A study of this situation in northeastern Pennsylvania has just been made. Low-grade anthracite is used, of course, but it's the freight rate that's important. The freight rate from a hundred miles away, mark you, not across the continent.

The public utilities in this small section of the country have consumed anthracite ranging up to 2,000,000 tons a year. The goal set in this new survey is sales of 4,000,000 tons annually to the utilities.

The contrast between the power dream at Bonneville, or Nebraska, and the power dream of the northeastern Pennsylvania coal miners is striking. But even Jesse Owens, flashing by, could notice two things. One, that the industries to consume this power are already there. They don't have to be coaxed, or subsidized, to come. Two, the consumers for the products made by these industries are already within short trucking distance.

News OF THE WEEK

Units of Electric Bond & Share Spend $210,000,000 In Additions

Groesbeck tells stockholders at annual meeting that current position has been bettered by $7,000,000 — Assails utility act as deliberate attempt to remake industry map of United States

Operating companies in the United States of the Electric Bond & Share system have expended approximately $210,000,000 for additions and improvements to their properties since the end of 1932, C. E. Groesbeck, chairman, told stockholders last week at their annual meeting.

Mr. Groesbeck added that in addition they have bettered their current position by $7,000,000. The fixed interest bearing obligations, through sinking fund, retirements and otherwise, have been reduced by $21,000,000, he said. Within the last year approximately $130,000,000 of mortgage bonds have been refinanced.

Trends in industry

Pointing out what he regarded as significant trends in the utility industry, Mr. Groesbeck said that the demand for electrical energy has been increasing, because of generally better business, new customers and expanding use of electrical appliances of all kinds. He added that the industry faces two major unfavorable factors, government competition and regulation and the increased cost of doing business. "Government competition plagues the industry and threatens its investors," he said.

The Public Utility Act of 1935 is a deliberate attempt by the federal government to remake the utility map of the United States, Mr. Groesbeck told stockholders. He asserted that the statute threw such a cloud on holding companies that their credit and ability to provide the necessary equity money to their operating subsidiaries was seriously impaired, if not destroyed.

Mr. Groesbeck said that the primary objectives of the utility act are in direct conflict with the major theories behind the formation and present structure of Electric Bond & Share and its associated holding companies, in that the act envisages only regional grouping in a single ownership of continuous properties and is generally directed against the financial grouping of diversified properties in a single holding company group.

Declaring that the Electric Bond & Share group had co-operated with public authorities in the suit instituted by the Securities and Exchange Commission, Mr. Groesbeck said that the policy will be continued. However, he said that a clear judicial determination for the protection of property rights was necessary.

Clear decision necessary

"In view of the many intricate legal questions which the act raises, and of the latitude of discretion intrusted to the SEC in its administration, no one can predict in what form, if at all, your company might be permitted to survive and carry on substantially the business which it now does," Mr. Groesbeck declared.

It was indicated by Mr. Groesbeck that "in the event the final court should hold that we must register, without determining the constitutionality of any other provisions, many of these other provisions sooner or later undoubtedly will be tested in the courts." He said that "it would be greatly to the advantage of your company, all other utility holding companies and many operating companies to have a prompt and final adjudication on the main features of this act at this time and in the present suit. If this cannot be done our future must remain uncertain until these questions are decided."

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Green to Form Utility Advice, Service Unit

Daniel C. Green, who recently resigned as president of Middle West Corporation, to become effective December 1, will enter the utility management business, it became known last week with the filing of articles of incorporation at Springfield, Ill., for the Central Service Corporation. Mr. Green resigned from Middle West when Purcell L. Smith was appointed chairman of the board.

The new company will sell service and advice to public utility companies, such service to cover practically all phases of the business, including finance, management, taxation, engineering, construction, reorganization, appraisals and special reports. It was indicated that service of Central Service will differ from present engineering firms or holding companies furnishing such service in that it will be independent rather than affiliated with a utility system.

Mr. Green will control the new concern, the headquarters of which will be in Chicago. It was indicated that there will be no financing in connection with its formation. Mr. Green said that affiliation with utility operating companies will depend on any contracts which Central Service Corporation might obtain.

Federal Control of Water Power Sites Assailed by Governor Aiken

Vermont executive tells meeting that New Englanders have been "let down" by Washington — Says four states involved in flood control pact could agree on joint program — Dr. Morgan addressed meeting

Vigorous championship of state rights in water-power sites and flood-control reservoirs featured a meeting of the New England section of the Society for the Promotion of Engineering Education held at Tufts College, Mass., recently, when Gov. George D. Aiken of Vermont addressed 300 delegates on "The Political Aspects of Flood Control in New England."

Speaking as an executive without public utility affiliations and as an advocate of rigorous regulation of the power industry, Governor Aiken reviewed the history of the interstate flood prevention compact for the Connecticut River Valley, lately blocked in Congress by the Administration's efforts to secure federal control of these facilities without regard to state rights.

New Englanders "let down"

The Governor intimated that New Englanders had been "let down" by Washington in this matter after protracted negotiations between the involved states had received favorable scrutiny of the War Department, only to be over-ruled by Executive insistence on federal control.

The Connecticut River compact between Connecticut, Massachusetts, New Hampshire and Vermont, Governor Aiken said, showed convincingly that the states could agree on a joint program despite contentions of opponents that jealousies would stand in the way. This was further illustrated by the statement that if the thirteen proposed reservoirs in the ultimate plan should be built in Vermont and used for flood control primarily, the electric power output would be but one-fifth as large as with reservoir development and use for hydro-electric production.

A long-range program for flood prevention has been developed under the compact plan approved by the legislatures of the four states, but the Administration's demands for federal control, whether with or without compensation to the states, and its reaching out for such control beyond navigable waters of streams to upper reaches and river tributaries threaten the very existence of state rights, the Green Mountain executive declared.

Assails New Deal

"The attitude of the Administration toward the New England Flood Compacts," Governor Aiken said in closing, "indicates clearly that the people must decide and decide quickly whether they wish to continue in our democratic form of government or to commit themselves to centralization and paternalism . . . let us, above all things, stear clear of plans for raising 140,000,000 well-fed guinea pigs and aim to preserve the ideals of initiative, self-reliance, thrift and love of liberty, adherence to which has made this nation great."

Dr. Arthur E. Morgan, chairman Tennessee Valley Authority, addressed the meeting on the place of the engineer in expanding government, urging integrity in public service, economic self-preparation to withstand attempted political exploitation and a fact-finding attitude in engineering activities affecting the public welfare.

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Air Conditioning Gains in Nebraska

Substantial increases in air-conditioning installations are reported by Omaha and Lincoln, the two largest cities in Nebraska.

The Nebraska Power Company, reporting for Omaha, lists 91 new installations totaling 1,451 hp. for the first six months this year, as against 88 installations totaling 1,300 hp. for all of 1936. Iowa-Nebraska Power Company, Lincoln, reports its commercial air-conditioning load totals 3,000 hp. at the present time, as against 1,000 hp. at the end of 1936. Largest of the new installations in Lincoln is the twelve-story Stuart building, totaling 700 hp. This building is equipped for year-around air conditioning with 450 Chrysler Airtemp individual room conditioners, which permit individual control by the tenants.

Air conditioning of the twelve-story Union Pacific headquarters building in Omaha, to cost $260,000, will constitute the biggest air-conditioning project of this kind in the Midwest, according to W. M. Jeffers, executive vice-president of the Union Pacific Railroad Company.

The installation, scheduled for completion in January, 1938, will total about 1,500 hp., with all controls, it is said. Approximately 90,000 cu. ft. of air per minute will be drawn into the building, washed, filtered and cooled by the equipment, which is to be used only during the summer months at present. An elaborate system of zoning will permit maintenance of even temperatures in the building to offset daily and seasonal traveling sun effect. Chrysler Airtemp equipment will be used.

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Large Savings Seen in Seattle Line Tie

Scheduled for completion the end of this year is the interconnection of Puget Sound Power & Light Company and Seattle City Light. The tie, estimated to cost $214,000, is under construction.

Gross savings estimated to accrue to the two systems during the 40-month life of the contract are $1,269,000, assuming average water years, $1,162,000 assuming minimum water years. In general, the city will draw power during October, November, December and January of minimum water years, the company during other months. The contract is essentially an arrangement for use of otherwise idle capacity, the company having steam, the city having hydro.

Power rates are to be: Hydro, 2 mills per kw.-hr.; steam from the company's Shuffleton plant, 4 mills; steam from the City's Lake Union plant, 7 mills. Preliminary estimates indicated that the city would use somewhere from 3,000,000 to 31,000,000 kw.-hr. per year of company steam, while the company would use somewhere from 81,000,000 to 164,000,000 kw.-hr. per year of city hydro.

Being built by the company is a 4-mile, 55-kv., aluminum-conductor line connecting its Canal Street sub-

station with the city's North receiving substation. A 30,000-kva. transformer bank at the city end will connect to its 26-kv. bus.

The three 10,000-kva. transformers are General Electric, water-cooled, with load control of plus or minus 10 per cent. Oil circuit breakers are to be furnished by Pacific Electric Manufacturing Company. The equipment will be leased and eventually purchased by the city out of proceeds from energy sale.

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St. Louis Apartments Get Air Conditioning

Ten new apartment house buildings in St. Louis have contracted for complete year-around air conditioning and a number of these have been completed and are ready for occupancy, according to recent information from the Union Electric Company of Missouri.

First installation of this type in St. Louis—and presumably first in the United States—was a three-story, six-apartment building constructed during October, 1936, ready for occupancy in March, 1937, and now fully rented. Individual units are installed in a small closet-like space in each apartment, supplied with hot water in the winter from a boiler in the basement, with cold water in the summer from a refrigerating machine in the basement. Piping system is concealed in the walls and units are provided with automatic, separate controls.

In ELECTRICAL WORLD for August 21, 1937, Washington, D. C., was credited with the first apartment house in the United States to be built with complete year-around air conditioning as part of the original design.

Rectifiers Seen Aiding Mining of Coal, Chlorine Production

A.I.E.E. Middle Eastern District meeting in Akron discusses industrial applications, power system problems and the Pennsylvania Railroad electrification program — Participants visit local plants

Coal mining in the new era has altered materially the approach to mine face power supply, A. Lee Barrett of the Pittsburgh Coal Company told the Middle Eastern District meeting of the A.I.E.E. in Akron last week. Substations must be moved oftener to keep up with face progress because mechanization has accelerated the advance.

Experience has shown that the mercury-arc rectifier type of substation can be relocated over a week-end and at a cost of only 2 per cent of the original installation. Unit elements of one installation are mounted on trucks and are supplied with plug-socket connectors. Because of the low load factor the higher relative efficiency of the rectifier in one instance is saving over one-fourth its cost each year by surpassing the efficiency of a motor-generator set.

Discuss rectifiers

Rectifiers applied to chlorine production by the Pittsburgh Plate Glass Company have carried 125 per cent of rating continuously for eight days without harm, according to L. T. Rimlinger. Backfires decreased after six months to one in 60 days. Outages amount to about 5 per cent of total operating time and these originate almost entirely with auxiliaries rather than with tanks. As for maintenance, both authors seemed to regard the rectifier as having lost its mystery, being capable of overhaul by ordinary electricians and in general needing no operating attendance.

What 10,000 men are doing to electrify some 373 more miles of the Pennsylvania Railroad west of Paoli to Harrisburg was graphically related by H. C. Griffiths. Spacing of the 22 new substations is 8 to 13 miles, in contrast to the 6 or 7 miles in previously electrified sections. No difficulty is anticipated as to system stability because none has been experienced on the New York-Washington section, even though the 25-cycle trunk is not paralleled by a 60-cycle tie directly joining the various sources of supply.

A large fraction of the 315 members and students in attendance visited the plants of the Ohio Brass Company and the Babcock & Wilcox Company at Barberton, as well as Nela Park and some of the rubber and aviation establishments of the vicinity.

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Purchases New Building

Wisconsin Gas & Electric Company, Racine, has purchased a four-story building on Main Street for the ultimate use as a salesroom and office quarters for all local employees. Eventually the building now occupied by the utility on Sixth Street is to be vacated and offered for sale.

CABLE SPECIALISTS—General Electric cable specialists, assembled at Bridgeport, Conn., Works recently for the annual three-day meeting, toured the factory, where all types of wire and cable are manufactured. The program included presentation of engineering and manufacturing reports on wire cable developments and advances during the current year

Drastic Drop In Security Prices Clouds New Financing Prospects

Consolidated Edison withdraws refunding issue of $60,000,000 debentures — Petitions commission for $30,000,000 of new 3¾% debentures—Appalachian Electric Power abandons refunding program

Unsettled conditions in the securities markets have clouded prospects of near refunding operations on a profitable basis, causing some companies to delay offerings of new securities.

Last week Consolidated Edison Company of New York, Inc., announced that it had withdrawn from prospective offering to the public its proposed refunding issue of $60,000,000 of 4½ per cent debentures included in a proposed financing program aggregating $80,000,000 in debentures.

Delay offering

Appalachian Electric Power Company, subsidiary of American Gas & Electric, announced this week the abandonment of its big financing program because of the collapse in the financial markets. The company stated that it had withdrawn the registration statement filed several weeks ago for $57,000,000 of 3¾ per cent first mortgage bonds and $10,000,000 of 4 per cent debentures. The financing constituted a refunding program.

Public offering of $13,000,000 notes of North Boston Lighting Properties has been deferred also because of the drastic drop in security prices. The company had filed an amendment with the SEC stating that the interest rate on the notes had been reduced from 3½ to 3¼ per cent.

Prices on utility and corporate bonds recently sold to the public have shown sharp drops from the original offering prices. The decline has been in line with the drastic decline in all securities, which reached panic proportions this week when all types of bonds and stocks were dumped on the market in the largest volume witnessed in recent years.

Belief exists in many quarters that the financial situation may have a decidedly bad effect on future prospects of utility financing, in which case the industry may find it difficult to finance construction programs. Several utilities have had under consideration for some time plans for refunding outstanding obligations into ones bearing a lower rate of interest and also plans for raising new capital to be used for plant expansion and improvements.

Ask $30,000,000 issue

Consolidated Edison filed a petition with the Public Service Commission last week requesting withdrawal of the $60,000,000 issue and at the same time requested authorization to issue $30,000,000 of new twenty-year 3¾ per cent debentures for construction purposes. Of the original $80,000,000 filed with the SEC $20,000,000 was to be utilized for construction and expansion purposes. Under the present plan Consolidated will forego the refunding operation and increase its financing for construction purposes from $20,000,000 to $30,000,000, all new money.

It was stated that when the original plan for $80,000,000 of financing was considered it was anticipated that the debentures could be sold bearing a 3 or a 3¼ per cent coupon. With the new debentures bearing 3¾ per cent interest, it was said that the saving in interest on any refunding operation was not enough to offset the expense incident to refunding outstanding obligations. On this basis indications are that the utilities will be forced to pay more for money needed to carry on construction and expansion programs than was the case last year.

Some time ago Floyd L. Carlisle, chairman of Consolidated Edison, said that the company would use $50,000,000 for new construction over the next twelve months.

•

Georgia Utility Wins Stay on Commercial Rate Case

Georgia Public Service Commission has granted the Georgia Power & Light Company a continuation on a commercial rate hearing scheduled for October 15. The commercial rate hearing was set when the commission cited the company to show cause why both residential and commercial rates should not be reduced in a large number of south Georgia cities served by the company. A reduction in residential rates already has been ordered and went into effect on September 1.

The company asked for a continuance of the commercial rate hearing because of the reduction in residential rates and the increased cost of materials. The company also promised to file with the commission this month a schedule of uniform commercial rates throughout the territory and reductions in wholesale municipal rates and wholesale power rates. The commercial rate hearing will go over until after January 1.

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Federal Power Policy Assailed by Willkie

The government's attitude toward the utility industry is blocking much-needed construction and financing, according to Wendell L. Willkie, president of Commonwealth & Southern Corporation.

Speaking before the Georgia Public Service Commission last week, Mr. Willkie declared that "the greatest need of the utility industry is a large amount of common capital which cannot be raised because of the degraded position of its junior securities in the market due to the attacks of the government and the Holding Company Act."

It was declared by Mr. Willkie that if the federal government would retire from the power business the power industries of the United States by the end of 1938 would have under way a construction program of $1,250,000,000.

The appearance of Mr. Willkie before the Georgia commission was in behalf of the Tennessee Electric Power Company, which is seeking permission to issue $1,500,000 of bonds to finance construction of a steam-electric plant at Nashville, Tenn. The Tennessee company does an interstate business and permission to issue the bonds must be obtained from the Georgia commission.

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Court Upholds Sale of Bonds By Sacramento Power District

Issuance of $12,000,000 of general obligation bonds by the Sacramento Municipal Utility District was upheld by the United States Circuit Court of Appeals. In its suit to prevent sale

of the bonds, the Pacific Gas & Electric Company claimed that taxation of its property to provide funds for establishment of a competitive publicly-owned power district would constitute confiscation of property without due process of law.

In its decision, the Circuit Court stated that the United States Supreme Court has determined recently that the supply of electrical energy to the public at large is a governmental function and declared that the Sacramento district should be allowed to act as a governmental agency to raise funds by general taxation for establishment of power facilities.

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Adds Lighting Specialists

The Charlotte, N. C., branch of the Duke Power Company has added two wiring and lighting specialists to its service—N. E. Tindal and J. W. Lewis. Both received training in the General Electric Company's laboratories at Nela Park, Cleveland.

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Louisiana Rural Service

Recent survey by the Louisiana Public Service Commission indicates that the private utilities in the state serve a total of 7,198 farms out of a possible 20,000 that may eventually be electrified.

West Penn Power to Cease Direct Sales of Residential Appliances

Plans an aggressive promotional program — New policy opens entire appliance field to dealers and removes anti-merchandising complaints — Expects satisfactory load growth — Move seen as satisfactory

After many years of domestic load building through the intensive merchandising of appliances by its subsidiary West Penn Appliance Company, the West Penn Power Company of Pittsburgh will, on December 31, discontinue direct selling of residential appliances and expand an aggressive promotional program, P. H. Powers, vice president of West Penn Power Company, announced this week.

New appliance stores

Reasons advanced for the new policy are: dealers are now in position to carry on; anti-merchandising agitation will be stopped; dealer and distributor good-will gained; no diminution of load building anticipated; dealers can sell promotional items such as ranges and water heaters; savings to company in store expenses, garage and transportation charges, office space, working capital and taxes.

Although West Penn's average domestic customers are using 860 kw.-hr. per year and paying an average bill of $35, the total residential business of $6,000,000 is but 25 per cent of total revenues.

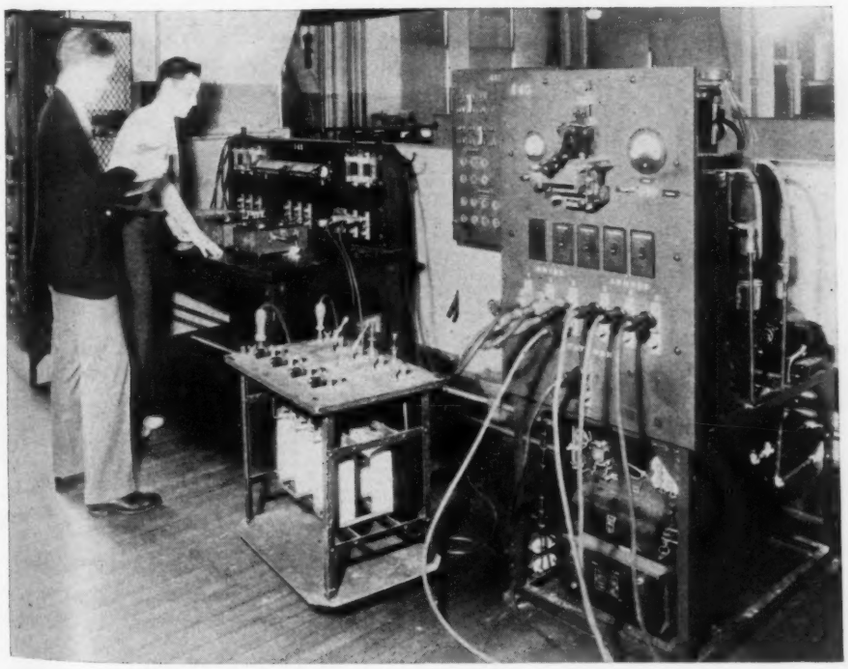
Any possible adverse effect upon West Penn employes has been practically eliminated. Steele R. Sellers, general manager of West Penn Appliance Company, will require upwards of 150 company employes for a new chain of independent appliance stores he will organize in West Penn territory. The window and floor display organization will continue as formerly and at least 25 to 30 appliance company employes will be nucleus of new dealer contact organization. Other employes have already received offers from dealers enlarging their organizations, and still other employes will be transferred within West Penn Power.

As a part of its program for more aggressive promotion, the company will adopt Reddy Kilowatt as a symbol of service, enlarge its advertising program, using all media including 75 newspapers in its territory, illuminated bill boards, and direct mail.

To expand organization

The enlarged dealer contact organization will become part of the sales promotion department, and will assist in training dealers' salesmen, increasing dealer interest and stimulating better dealer displays and advertising. Company stores and show windows will be used to display dealers' electrical merchandise and also to foster broader uses of electric service.

Decision to withdraw from direct residential selling was reached, company officials said, after complete analysis of the problem begun some months ago. Detailed analyses of costs, the experiences of other utility companies and the possibilities of six possible courses, ranging from a more intensive merchandising activity on one hand to complete withdrawal from both sales and promotion on the other, received careful consideration before the new policy was adopted.



STUDENTS STUDY RECTIFIER—This laboratory model mercury arc rectifier, developed by Allis-Chalmers, embodies all the characteristics of large commercial equipment and is demountable so that students may learn construction and operation. They have been installed at M.I.T. and Cornell and purchased by Harvard and Columbia

Court Holds Invalid Utility Law of Indiana

Judge Edgar A. Rice of Crawfordsville, Ind., held invalid this week the Indiana utility law enacted in 1933 under the leadership of former Governor McNutt to open the way for acquisition of utility properties by municipalities.

Ruling on an action brought by the city of Lebanon for acquisition by condemnation of the Lebanon property of Public Service Company of Indiana, Judge Rice held the act unconstitutional and sustained the demurrer of the utility which set out that under the 1933 law the proceedings would result in taking of the utility property without proper compensation.

The conclusions of Judge Rice were based principally on decisions by the Supreme Courts of New Jersey and Texas, which held that similar laws enacted in those states were unconstitutional.

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Georgia Co-operative Reduces Rates Again

Dr. W. A. Chapman, president and project superintendent of the Altamaha (Ga.) Electric Membership Corporation, formerly the Toombs Rural Electrification Administration, recently announced a reduction in rates, which, he claimed, would result in saving of at least half the electric bill to the customers.

This new and second reduction in rates since the facility started serving its members comes through an arrangement with the Georgia Power Company and is described as the removal of the twelve months' minimum demand charge.

With every consolidated school on the power lines of the Altamaha facility wire, plans are in progress for conducting training schools and demonstrations in the use of power appliances through the school term. Recently another $1,000,000 was budgeted for line extensions.

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New Brunswick Power Plans Addition to Power Capacity

New Brunswick Power Company, St. John, N. B., subsidiary of Federal Light & Traction, plans expenditure of between $600,000 and $700,000 for purchase and installation of a new steam turbine generator and boiler, according to W. P. Southard, vice-president and general manager.

The new equipment will be either 7,500 or 10,000 kw. capacity, and if the latter, it would almost double the present capacity of 11,000 kw.

Mr. Southard has notified the City Council that it must decide before late autumn if the city will accept the offer of the company to sell all of its assets for $3,250,000.

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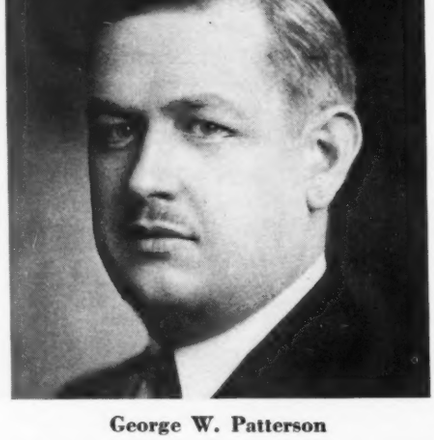
Patterson Receives J. H. McGraw Award

In recognition of his constructive contribution to the advancement of the contractor-dealer branch of the electrical industry, George W. Patterson, president of Patterson Electric, Ltd., of Toronto, has been awarded the Contractor-Dealer Medal for 1937, given under the James H. McGraw Award. Presentation was made at the annual banquet of the National Electrical Contractors Association in Los Angeles last Wednesday.



George W. Patterson

As chairman of the cost data committee of N.E.C.A., Mr. Patterson established, from N.E.C.A. cost data, the present Manual of Labor Units and its supporting monthly service of information for estimators on electrical construction.

The committee of judges appointed to award the medal, one of four given under the James H. McGraw Award, were E. G. May, Howard L. Miller, president of the Utilities Engineering Company; S. J. O'Brien, president of S. J. O'Brien, Inc., and J. Roland Stolzenbach of the Roland Electrical Company.

Decision Is Reserved In TVA-Utilies Suit

The Fifth U. S. Circuit Court of Appeals, in New Orleans, on Tuesday reversed a decision of Judge David J. Davis of the District Court for Northern Alabama barring the Alabama Power Company from participation in the suit by eighteen Southeastern utilities challenging the constitutionality of TVA.

This means that unless this action is appealed the Alabama company will participate, although a similar order of a Georgia District Court forbidding the Georgia Power Company from participation was, in effect, upheld by the U. S. Supreme Court on October 11.

The Circuit Court ruled that the Alabama District Court could not interfere in the conduct of a suit already under way in another District Court.

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New Rural Schedule Filed in Northwest

New wholesale power rate schedules affecting federal rural electrification administration projects in Washington and Idaho have been filed by the Washington Water Power Company. REA will build its own lines under the agreement reached with the Washington Water Power Company, which will supply the power at points of contact between its lines and the lines of the REA. Customers of the REA will receive rates as low as those now enjoyed by regular patrons in cities served by Washington Water Power, it was stated by the Department of Public Service at Olympia.

Following are the new wholesale rates as given out by the rate department of the utility company: Three dollars for the first kilowatt of demand a month, which will include 200 kw.-hr. Next 100 kw., 1 cent a kilowatt; all over 300 kw., six-tenths of a cent a kilowatt.

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Greenwood County Intervenes

Attorneys for Greenwood County, South Carolina, have filed a brief with the U. S. Supreme Court asking it not to review the request of the Duke Power Company for an injunction against a PWA allotment for the construction of the Buzzards Roost hydro-electric power project.

Audit of City Plant Shows Annual Deficit

A recent report on the financial status of the municipal electric plant at Mason City, Nebraska, as published in *Current Topics and Events*, house organ of the Iowa-Nebraska Light & Power Company and the Maryville (Kans.) Electric Light & Power Company, indicates an annual deficit for the plant of approximately $1,000.

Previous to 1931, the village operated a d.c. plant. With the proceeds of the sale of $21,500 in warrants, payable solely from the earnings of the plant, the villages purchased one 125-kva. Worthington Diesel unit and a 20-kva. generator, which was belted to an existing 25-hp. Fairbanks-Morse Diesel engine. Two or three panels of switchboard were also purchased and the distribution system was changed from d.c. to a.c. Distribution system is 110-120 volts, with fairly large-sized copper and a few new, reasonably-sized poles. In 1935, the plant generated 92,460 kw.-hr. and in 1936, 97,380 kw.-hr. Street lighting system consumes an estimated 7,000 kw.-hr. yearly.

The accountant's report, covering the period from May 1, 1934 to May 27, 1936, shows that the gross profit for the period was $3,325; the total estimated investment, $26,000; the total fixed charges, $5,400, giving a deficit of $2,074 for the 25-month period, or about $1,000 a year.

•

N. Y. Rate Probe Extended

Investigation of rates charged by municipal power plants in New York State has been extended by the Public Service Commission to Hamilton, in Madison County, and Endicott, in Broome County. Hearing will be held on October 27 in Hamilton and one will be held on the following day in Endicott.

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Asks FPC to Establish Rate For Interstate Energy Sale

Charging that the rate for electric energy charged the Delaware Power & Light Company by the Philadelphia Electric Company, both subsidiaries of the United Gas Improvement Company, is "unduly preferential" and substantially below production cost, State Senator H. Jerome Jaspan has asked the Federal Power Commission to fix a just and reasonable rate to be charged for the energy exchange.

In his complaint, the Senator stated that approximately 172,000,000 kilowatt-hours of energy was being transmitted across the State line annually, and was being sold to the Delaware company at 4.9 mills per kw.-hr., while its cost was from 1½ to 2 cents per kw.-hr.

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Low Water Forces Montana Utility to Curtail Service

Mountain States Power Company, Montana, announced recently that because of low water it was, for the first time in its history, forced to curtail service. Swan Lake, providing storage for Big Fork plant, was at the lowest level ever recorded.

During the emergency, expected to last 30 days, Kalispell, Whitefish, Columbia Falls and Big Fork will be without energy from 12:30 a.m. to 5 a.m. Some aid is being received from the Great Northern and the Somers Lumber Company steam plants, but relief is not expected until fall rains begin, or until a line, now being run to Montana Power Company facilities, is completed.

Effect of light rains in Montana early this month was neutralized by excessive evaporation during an abnormally hot, dry September.

High-Temperature Furnace Element

An electric furnace element, said to be capable of operating at 3,000 deg. F., is to be exhibited under operating conditions in Pittsburgh during the first week in November. The element was developed by Dr. Paul Schwarzkopf in his laboratories at Reutte, Austria; he is bringing to the United States an electrically heated furnace containing eight of the new elements.

The makers claim that such elements, after operating 4,400 hours at 3,000 deg. F., have shown no evidence of deterioration. As a result of European tests, it is reported, the element appears to be resistant to hydrogen, oxygen, hydrocarbon, sulphur and its combinations.

Arrangements for the testing were completed in behalf of Dr. Schwarzkopf by Pierce T. Wetter of American Cutting Alloys, who stated that manufacturers and users of electric furnaces would be invited to check the tests.

He added that M. H. Mawhinney, consulting engineer, had been retained to work with manufacturers in studying the new element for possible application in industrial furnaces in this country. (Elements now in use in electric furnaces have an upper limit of about 2,400 deg. F.)

FOR THE WHEELS OF INDUSTRY—Speeding work on the production line at the Westinghouse Electric & Manufacturing Company plant to supply the demand from industry for motors and equipment. The company is experiencing great activity.

High-Tension Systems Topic of World Group

A total of 1,195 participants, representing 41 different governments, attended the ninth session of the biyearly International Conference on High-Tension Electric Systems, held recently in Paris, setting new records in attendance and representation. The conference is the only international organization devoted to the bringing together from all countries of all those interested in the design, construction and operation of high-tension electric systems.

While 28 American delegates registered, only eleven were able to attend, the delegation being under the chairmanship of Frederic Attwood, vice-president of Ohio Brass Company. Six American engineers presented reports, this number being the limit allowed the American group.

The board of directors of the American Institute of Electrical Engineers cabled an invitation to the general assembly of the conference welcoming members to attend the 1938 A. I. E. E. convention in Washington. A group visit of twenty to thirty international technicians to this convention is planned by the conference. The next session of the conference is to be held in Paris in June, 1939.

•

Cleveland Electrical Mart And Sales Clinic a Success

With orders amounting to about $50,000 placed with exhibitors by visiting dealers, Cleveland's first Electrical Mart and Sales Clinic is reported as a success, from the standpoints of both visitors and exhibitors.

Over 400 dealer executives, supplemented by some 600 dealer salesmen and other visitors, attended the Clinic during one or more of its four days. Distributors and jobbers' representatives pointed out that this cooperative display had definitely stimulated dealer interest in electric appliances.

•

350,000 See League Exhibit

The Electrical League of Cleveland's exhibit in the Hall of Progress at the Great Lakes Exposition was visited by over 350,000 in the 121 days the Exposition was open to the public in 1937. The League exhibit, which featured residential electrical equipment, did much to accelerate equipment sales in Greater Cleveland during the coming months, it is said.

•

N.E.M.A. Prepares For Annual Meeting

With indications at present of approximately 150 separate meetings during the convention, final preparations have been made for the National Electrical Manufacturers Association annual meeting, to be held the week of October 24 at the Palmer House in Chicago.

The nominating committee has recommended the following men for the Board of Governors: Terms expiring 1940: G. H. Bucher, executive vice-president, Westinghouse Electric & Manufacturing Company; L. W. Grothaus, vice-president, Allis-Chalmers Manufacturing Company; Leonard Kebler, president, Ward Leonard Electric Company; F. W. Magin, president, Square D Company; C. L. Peirce, Jr., president, Hubbard & Company; H. C. Petty, vice-president, Crocker-Wheeler Electric Manufacturing Company; D. G. Phelps, vice-president, Colt's Patent Fire Arms Manufacturing Company; Matthew Porosky, vice president, The Gamewell Company; C. E. Swartzbaugh, president, Swartzbaugh Manufacturing Company; B. M. Tassie, president, Manning-Bowman & Company.

Term expiring 1939: P. W. Conrad, vice-president, Automatic Electric Company.

Terms expiring 1938: G. F. Elliott, chairman of the board, Elliott Company; J. S. Lawson, vice-president and general manager, Memco Engineering & Manufacturing Company.

The 13 vacancies will be filled by the policies division at its meeting on October 27. Speeches by several prominent industrial leaders will also feature this meeting.

Meetings

National Electrical Manufacturers Association — Annual convention. Palmer House, Chicago, October 24-30. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

Wisconsin Utilities Association—Electrical section, commercial and technical divisions, convention and exhibit. Pfister Hotel, Milwaukee, Wis., November 11-13. A. F. Herwig, executive secretary, 135 West Wells St., Milwaukee, Wis.

American Society of Mechanical Engineers —Annual meeting, New York, N. Y., December 6-10. C. E. Davies, national secretary, 29 West 39th Street, New York, N. Y.

Festival of Better Living Celebrated

A "Festival of Better Living" is announced for Tucumcari, New Mexico, for the remainder of October and November, sponsored by the local electrical industry. In the words of H. R. Morley of the Tucumcari Light & Power Company "nothing so completely stands for the universal comforts of this scientific age as the many home conveniences operated by electricity."

Tied in with this celebration inaugurated by electrical equipment merchants and the light and power company is local participation in the nation-wide "New American Better Living" essay contest being conducted by the General Electric Company in which $40,000 in prizes are being offered.

The real feature of Tucumcari's "Festival of Better Living" was "Better Light Week" which was observed in schools, clubs and business establishments during the past week. A graphic demonstration of the value of electricity to a happy home was given. B. J. Graham, lighting engineer, General Electric Company, explained the value of better lighting, not only in the home, but in the business place as well. Mr. Graham also demonstrated lighting to the school children.

This celebration is the thirty-fourth anniversary of the beginning of electrical living in Tucumcari.

•

Light-Sight Movement Ends Its Fourth Year

More progress was made last year in promoting the principle of Better Light-Better Sight in schools than in the previous ten years, according to the National Better Light-Better Sight Bureau, which reports that improved lighting was installed in more than 700 schools.

In its fourth annual report, recently released, the bureau indicates that 1,100,000 lamps bearing the I.E.S. tag were sold during the year and estimates that an equal number was sold without tags. In addition, it is believed that there are some 7,000 people in the electrical industry trained and encouraged to sell better lighting, eye care and proper reflecting surfaces.

Output Level for Fifth Week

Production, down slightly from preceding week, remains on plateau 5% above 1936

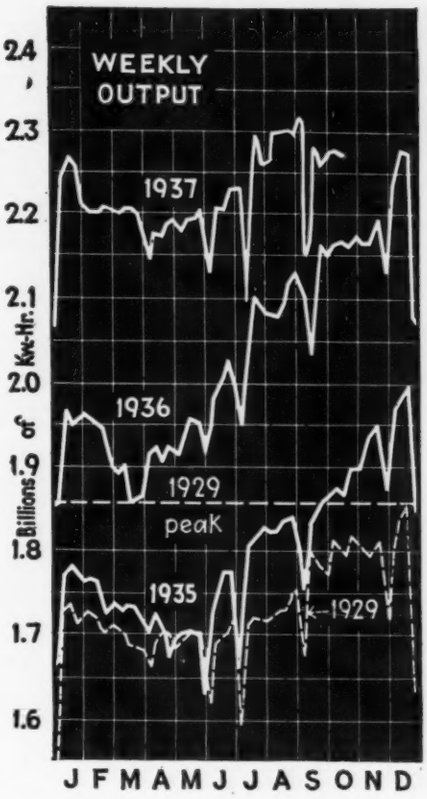
Energy production by the electric power and light industry remains close to the level established in the middle of September and maintained with minor fluctuations for five consecutive weeks. During the week ended October 16 it receded slightly to 2,276,123,000 kw.-hr., according to the Edison Electric Institute. The excess of 5 per cent over the corresponding period of 1936 was equal to the average for the preceding three weeks and it indicates that operations are above the previous record for this season of the year by that amount, although short of the all-time peak of the week of September 4. Compared with 1935 there has been an increase of 22 per cent.

Regionally most of the percentages over a year ago are close to the nation-wide figure. The chief exception is New England, up only 1.1 per cent.

The Central industrial area continues above the average, but the margin is decreasing. In the Mountain States it has dropped from 20 per cent in August to 6.7 per cent.

Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
Oct. 16...2,276	Oct. 10..2,168	Oct. 12..1,867
Oct. 9...2,280	Oct. 3..2,169	Oct. 5..1,863
Oct. 2...2,276	Sept. 26..2,157	Sept. 28..1,857
Sept. 25...2,266	Sept. 19..2,171	Sept. 21..1,852
Sept. 18...2,281	Sept. 12..2,029	Sept. 14..1,828
Sept. 11...2,154	Sept. 5..2,099	Sept. 7..1,752



Per Cent Change from Previous Year

Region	Week Ending Oct. 16	Oct. 9	Oct. 2
New England	+ 1.1	+ 4.1	+ 0.7
Middle Atlantic	+ 4.8	+ 5.4	+ 3.6
Central Industrial	+ 6.6	+ 7.3	+ 7.7
West Central	+ 5.8	+ 5.3	+ 5.5
Southern States	+ 6.8	+ 7.1	+ 6.2
Rocky Mountain	+ 6.7	+ 5.7	+13.0
Pacific	+ 4.6	+ 3.4	+ 4.9
United States	+ 5.0	+ 5.1	+ 5.5

London Utility Plans 100,000-Kw. Addition

The Central Electricity Board has authorized the London Power Company to proceed with its plans for extending the station by the installation of a plant of 100,000-kw. generating capacity, reports the U. S. Department of Commerce. Cost of plant extensions is placed at £1,500,000 (about $7,500,000).

The 100,000-kw. addition, together with the 243,000 kw. already installed, is expected to take care of increased demands for electricity during the winter of 1939-40. Ultimate capacity of the station is 500,000 kw.

Two interesting developments in power-station practice are reported for this installation. Instead of one set producing 100,000 kw., one high-pressure set, generating 16,000 kw., will exhaust into a low-pressure set generating 78,000 kw. and a house set, generating 6,000 kw. New plant will also include one boiler of 550,000 lb. evaporative capacity, instead of the usual four or five boilers, said to represent a departure from engineering technique in the United Kingdom.

•

Illinois Sales to Consumers Show 8% Gain for September

Sales of electricity to ultimate consumers, as reported by eleven large companies in Illinois to the Rates and Research Section of the state Commerce Commission, show a gain of 7.9 per cent for September, 1937, over September, 1936, but were 0.7 per cent lower than those reported in August. Sales amounted to 602,031,259 kw.-hr. for September this year, as against 557,853,855 for the corresponding month last year.

Sales of the Commonwealth Edison Company for these periods were up 6.2 per cent, rising from 327,143,709 kw.-hr. to 347,335,685 kw.-hr. Sales for the other ten companies reporting totaled 254,695,574 kw.-hr., as compared with 230,710,146 kw.-hr., a gain of 10.4 per cent. However, all these percentage increases are considerably lower than those established for September of the 1936-35 period.

•

Soviet Railroad Electrified

With a new section of 184 km. from Goroblagodatskaya to Chusovaya (U.S.S.R.) opened for operation, the electrification of the railroad from Sverdlovsk to Kizil is complete, according to reports of the U. S. Department of Commerce. Both passenger and freight movements are effected by electricity on the line of more than 600 km., which is said to be of great economic importance to the Urals, the factories and mines at Sverdlovsk and other mines north.

•

Electrified Cotton Gins

Operation of cotton gins by means of electricity furnished in most instances by TVA or REA is being tried out on a considerable scale in Mississippi and Louisiana for the first time this cotton crop season. Heretofore only a few scattered gins have tried electrical energy, but this year the number has been trebled and results are reported as highly satisfactory.

It is estimated that approximately 150 gins in north Louisiana and the Mississippi Delta are using electricity for the first time this fall.

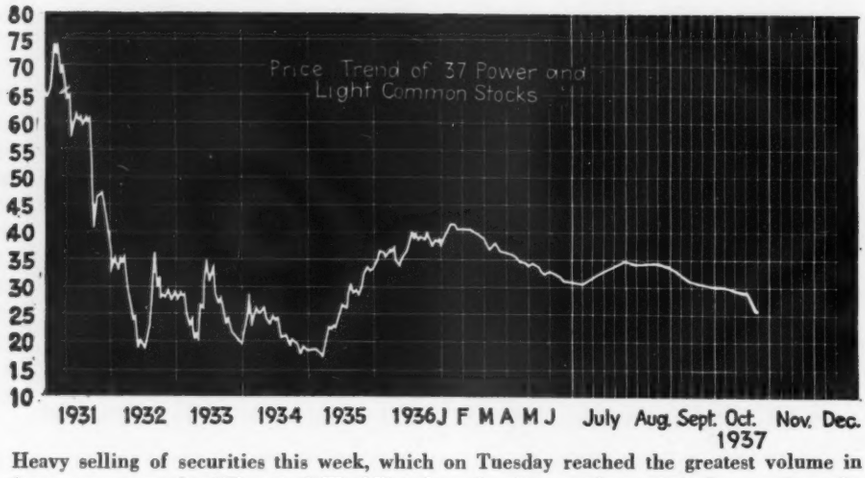
•

Output 7% Higher in France

Production of electricity by the 68 producing and distributing electrical stations in France showed an increase of 7.13 per cent for the first six months of 1937 over the corresponding period of 1936, according to the U.S. Department of Commerce.

Output totaled 6,067,013,185 kw.-hr., as against 5,663,298,593 kw.-hr. for the earlier period; these figures represent about 92 per cent of the energy produced in France by the stations supplying the distribution system, not counting mines and metallurgical exploitations.

Utility Stocks Lowest in Two Years



Heavy selling of securities this week, which on Tuesday reached the greatest volume in four years, sent the "Electrical World" index of utility stocks to 25.3, lowest since the week of June 22, 1935, when it was 25.1. Low since recovery, 17.5. Index preceding week, 28.4; year ago, 38.2; 1937 high, 41.5

Abitibi Bondholders Accept Ripley Plan

The Ripley plan of reorganization of the Abitibi Power & Paper Company, Ltd., was approved at a meeting of bondholders held in Toronto on October 15. The vote was: for the plan, 238,695 votes, representing $23,869,500 par value of bonds; against, 76,845, representing $7,684,500 par value of bonds.

The meeting was called under a court order to vote on the plan of sale of assets and reorganization presented by a committee headed by Joseph P. Ripley of New York.

The committee proposed that $14,000,000 of prior lien bonds be issued for working capital purposes. In addition, the plan provides for issuance of $24,133,500 of general mortgage convertible 5 per cent bonds and convertible income debentures to the amount of $33,786,900.

The meeting nominated eight persons to be Class A directors.

•

SEC Seeks to Intervene

Federal Judge Holly has delayed until November 30 the hearing on petition of Utilities Power & Light Corporation to dismiss its voluntary petition for reorganization. Motion for dismissal was opposed by O. J. Rogge, special counsel for the Securities and Exchange Commission, who, in seeking limited intervention, charged that there has been too much "sparring and shadow boxing" in the reorganization proceedings. The motion was filed by the company attorneys after Judge Holly appointed a trustee in opposition to the stand of the company which insisted that it should be permitted to continue in charge of its own affairs pending adoption of a reorganization plan.

•

Utility Security Index Declines to New Low

Utility stock prices, as measured by the ELECTRICAL WORLD index of 37 representative common stocks, this week reached the lowest point since the week of June 22, 1935, when the index was 25.1 at a time when the utility act was nearing enactment.

From a high of 41.5, reached the week of January 16, 1937, the averages slid off to a low of 30.6 in early July, but rallied to 34.7 in the last week of July. From that point the trend turned downward, reaching a low point of 25.3 this week, a decline of 16.2 points, or over 39 per cent, from the high reached in January this year.

The utility index from a high of 74 in March, 1931, dropped to a low of 18.5 in the week of June 28, 1932, and after an irregular movement sank to a low of 17.5 the week of March 16, 1935, when the utilities were under heavy governmental attack.

Utility bonds are also off sharply since the high reached in January this year. The index of 50 representative bonds now stands at the lowest point since early 1935. The uncertain conditions in the markets have caused postponement or abandonment of several pending issues.

•

Utility Makes Exchange Offer

Formal offer by the Commonwealth Edison Company to exchange its own $25 par value stock for securities of the Public Service Company of Northern Illinois, the Western United Gas & Electric Company and the Illinois Northern Utilities Company was announced recently. The offer, which will expire November 15, will involve the issuance of 3,320,849 shares of Commonwealth common, it is said.

•

Stock Acquisition Permitted

Maryland Public Service Commission has passed an order authorizing the American Water Works & Electric Company to acquire from the West Penn Electric Company all the outstanding common capital stock of the Potomac Edison Company. Application for the authority to acquire the stock upon the dissolution of the West Penn company was filed with the commision several weeks ago.

•

Authorized to Issue Bonds

South Carolina Public Service Commission has granted the application of the South Carolina Power Company for authority to issue and sell $85,000 in first and refunding mortgage bonds, 5 per cent series due 1957, at a price not less than 90 and accrued interest to date of sale.

Earnings Reports (Utilities)

	Net Income 1937	1936
†Elec. Bond & Share...	$10,157,539	$9,315,901
†The Detroit Edison and subs.	10,872,633	11,109,417
*Amer. G. & E. and subs.	13,242,277	11,550,959
*Calif. Oregon Pwr.	1,105,148	883,005
*Louisville G. & E. (Del.) and subs.	1,667,081	1,635,052
*Louisville G. & E. (Ky.) and subs.	3,047,441	2,897,067
*Amer. Lt. & Trac. and subs.	5,919,580	5,368,893
*Cont. G. & E. and subs.	4,648,725	4,231,600
*United Lt. & Pwr. and subs.	5,193,306	4,425,476
*Dallas Pwr. & Lt.	1,549,365	1,396,614
*Minnesota Pwr. & Lt.	1,361,261	1,304,322
*Louisiana Pwr. & Lt.	1,024,412	1,172,201

* Twelve months ended August 31.
† Twelve months ended September 30.

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Emergency Kits Speed Cable Repair

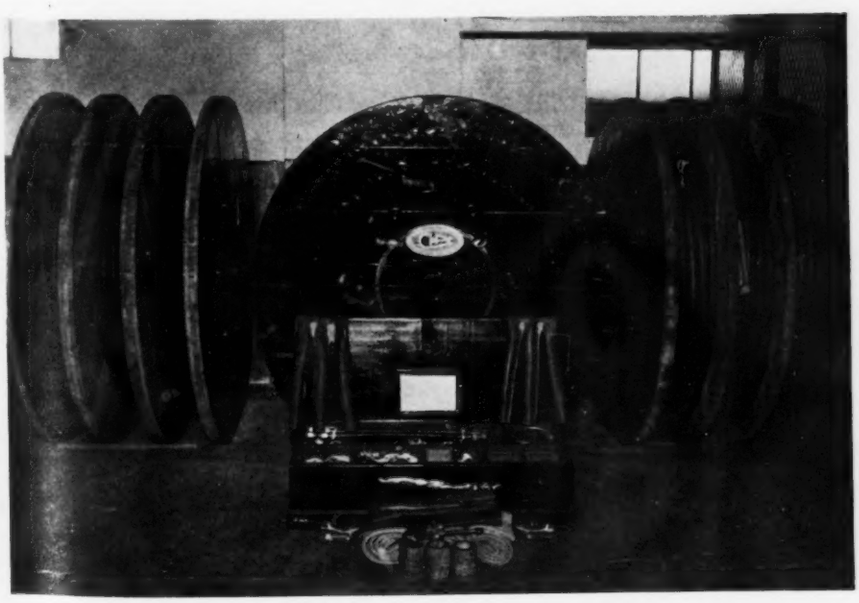
To speed up service restoration in emergencies in the twelve districts supplied with electricity on the system of the Connecticut Light & Power Company four portable cable kits are maintained at Waterbury and other strategic points "earmarked" for primary use under abnormal conditions. These kits contain 2-ft. lengths of various-sized cables, mechanical connectors, tape, hose and other supplies as tabulated here for a typical kit located in the Waterbury storeroom.

The emergency supply material includes three-section reels of Kerite cable with seine covering for mechanical protection, which enables one, two or three conductors to be unreeled at a time. The cable is 1.45 in. in diameter and weighs 1.1 lb. per foot. The reels are painted red, are marked "Emergency Cable" and are 60 in. in diameter and 31 in. wide. They weigh loaded from 1,000 to 2,000 lb. and the cable is rated at 15 kv., No. 0 conductor being used. Lengths reeled are 100, 200, 300 and 500 ft. and the cable is intended for use up to and including 13.8-kv. circuits. It may be run underground, aerially or laid on the ground when properly protected and clear of traffic. As it has a non-grounded covering, care is taken in using it at the higher voltages to avoid contacts with it in the field.

Emergency Kit Inventory

1—Can varnished cambric tape
4—Rolls Kerite tape
4—Rolls friction tape
2—10 inch wrenches
3—500 MCM cable with connectors
3—350 MCM cable with connectors
3—300 MCM cable with connectors
3—No. 4/0 cable with connectors
3—No. 1/0 cable with connectors
3—No. 4 cable with connectors
3—No. 6 cable with connectors
6—350 MCM to No. 1/0 connectors
6—No. 4/0 to No. 1/0 connectors
6—No. 2/0 to No. 1/0 connectors
6—No. 4 to No. 1/0 connectors
6—No. 6 to No. 1/0 connectors
6—No. 2 connectors
3—No. 4/0 "Bug" connectors
6—No. 1/0 "Bug" connectors
3—Snap-on ground clamps
1—Ground clamp stick } Not in box
3—Kerite tubes 5 in. x 5 ft. } Not in box
3—Trifurcated rubber tubes }
6—Salisbury line hose 1¼ in. x 3 ft.
4—Rolls rubber bandages

Note—Equipment marked "not in box" is wrapped in waterproof cover which is kept with the box.



Emergency cable and supply kit earmarked for trouble use at Waterbury

Ice Lowers Conduit Evenly

Lowering conduit with minimum strains by supporting sections on ice blocks is coming into wider use on warm weather jobs. As recently applied on the Worcester County Electric Company's system on a grade-reducing job on Chandler Street, Worcester, Mass., the Allen Contracting Company of that city found that sections about 100 ft. long could be lowered at one time with ice, leaving the construction force free to carry on excavation ahead of the section supported and eliminating the use of tripods and chain hoists to ease down the ducts. In handling conduit with chain falls it is customary to support 16-ft. length by two sets of falls attached about 4 ft. from each end. The work had to be done with extreme care in order to avoid dangerous strains and cracks.

On the Chandler Street job the conduit line consisted of four 3.5-in. fiber

THE WATTHOUR METER FOR SINGLE-PHASE LOADS—LARGE AND SMALL

WIDE-LIMIT

Presenting

THE WIDE-LIMIT METER

A single-phase watthour meter that has an operating range of 1200:1 . . . a development that has long been in progress . . . many samples made and tested before deciding on the final design . . . then, an exactitude of manufacturing control that assures a high degree of product uniformity . . . General Electric's most recent noteworthy contribution to the metering art—the wide-limit meter.

THIS is the watthour meter that will serve for both large and small single-phase loads.

It is a meter that starts on loads of less than one-half per cent of its nameplate rating. It is a meter that accurately measures loads up to four times its nameplate rating.

It is the new General Electric Type I-30 watthour meter with straight-line characteristics between wide limits.

The intent of this development was to make available to electric-service companies a meter that would have very broad applications. In every sense of the word, therefore, the I-30 is the modern watthour meter for present as well as future loads.

Consider the benefits that are to be derived from the adoption of the Type I-30 watthour meter. It will enable you to reduce inventory investment; and this will be coupled with maintained accuracy over many years, improved revenue, and unusually low maintenance expense.

Further information to help you determine the suitability of this meter for all your single-phase loads will be gladly furnished on request to the nearest G-E sales office or General Electric, Dept. 6—201, Schenectady, N. Y.

GENERAL ELECTRIC

400-24

ducts carrying primary cable and city fire alarm circuits, the ducts being encased in concrete. Ice blocks cut to approximately 12-in. cubes on the ground were placed under the conduit run about 6 ft. apart after suitable

Ducts sank 1.5 in. per hour at 85 degrees F.

trench excavation, temporary supporting blocks being placed before setting the ice blocks in place. To insure ample flexibility, the fiber conduit was cut open for about 30 in. every 60 ft., recovering with split duct before backfilling. On this particular job the grade was lowered 13 in., and the average rate of descent at about 85 deg. F. was about 1.5 in. per hour. About 1,000 ft. was included in the sections lowered by ice melting. The method is most effective where there are enough sections to enable the force to work on other parts of the job while melting is in progress.

•

Height and Class of Poles in Detroit

Even though the height and class of poles will often be determined by special local conditions, it is advisable to have standards to cover the majority of cases. The following general standards are prescribed by The Detroit Edison Company:

Height and Class—The following indicates the *minimum* height and class of poles to be used for the purposes indicated. Higher poles may be used when necessary to clear obstructions, handle street lighting or additional wires, etc. Stronger poles may be used when calculations show the minimum-sized to be overloaded.

Future needs should be anticipated in selecting a pole for a given load.

	Height, Ft.	Class
(1) 24-kv. lines	40	5
(2) Distribution lines, within the city of Detroit, in streets, alleys, easements, back lot lines, etc	40	5
(3) Distribution lines, outside the city of Detroit, in streets or alleys		
(a) With joint use	40	5
(b) Without joint use	35 a	6
(4) Distribution lines, outside the city of Detroit, in easements, back lot lines, etc.		
(a) Without joint use or with joint use where communication lines do not cross highways or private roadways	35	6
(b) With joint use where, communication lines may cross highways	40	6
(5) Rural distribution lines on or paralleling roads		
(a) Non-select poles	30 a	7
(b) Other poles	35 a	7
(c) Farm line spans over 400 ft	35	6
(d) If joint use is necessary in cases (a) or (b) a higher pole may be necessary, depending upon the proper ground clearance.		
(6) Service poles and extensions on private property	30	7
Exception — This height may be reduced at a service entrance to improve sightliness.		
(7) T or L corner poles — one class higher than the line poles... (Class 3 in a Class 4 line, etc.).	..	b
(8) Sidearmed poles — one class higher than for cross-armed poles in the same location...	..	b
(9) Supporting transformers.		

Single-phase, Kva.	3-phase, Kva	Constant Current, Kvs.	Transformer Weight, Lb.	Class
1.5 - 5			300	7
10 - 15	5	5	600	6
25 - 50	10 - 30	7.5 - 20	1,400	5
- - - - - - - - - - - - - - - - - - - -			1,800	4
- - - - - - - - - - - - - - - - - - - -			2,200	3
75 - 100	37.5 - 100	30	2,600	2
Two 100	100, also 25		4,000	1
(10) One-pole platform				2
(11) Two-pole platform				5
(12) Cable poles:				
(a) 24-kv. or 4,800-volt				2
(b) Sidearm primary cable pole not tied to building				1
(c) Direct current or street lighting				6
(d) Secondary				7
(13) Pole-top switch				2

"a" — If services or secondaries will cross a street or road 5 ft. higher crossing poles may be necessary.

"b" — The requirements shall not be cumulative.

Adjacent poles in a lead shall be of such a height that the requirements with respect to the vertical uplift on pins shall be met. On farm lines this shall be the only requirement as to changes in elevation of supports of conductors. On other types of lines, in order to obtain a good appearing lead, points of conductor supports on adjacent poles preferably should not differ more than 5 ft. in elevation from the average grade in level or the average slope in hilly country.

Use of Stubs—Where existing poles are not available a guy stub shall be used:

(1) For the lower ends of arm guy attachments.

(2) To provide adequate ground clearance for guys.

(3) To secure adequate wood insulation on 24-kv. guys.

Where possible a 22-ft. stub shall be used rather than a higher one.

A-Frames—An A-frame shall be used in place of a side anchor guy where the anchor guy is likely to be broken by traffic and where it is most economical.

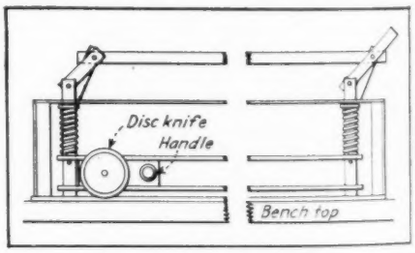
Joint Use—In order to keep the number of poles to a minimum, joint-use leads shall be built wherever and whenever feasible.

Location—Cities and Villages—Poles preferably should be arranged so that drops may be run from lines in the rear of buildings being served. Lines in front of property should be avoided; leads on streets passing by the sides of buildings are not considered objectionable. The policy in laying out overhead circuits is to avoid all boulevards and mile and a half-mile thoroughfares, designated as being 86 ft. or wider by the County Master Plan. Short sections of line may be run along such streets if an unreasonable expenditure would be required to avoid them.

•

Devise Simple Cutter for Insulating Paper

No helper in a motor or transformer repair shop has ever cut a dozen or so strips of fish paper or other kind of insulating sheet that toughly resists attack of scissors or knife without wondering why the boss doesn't put in a machine to do that hand-tiring work. The answer is, of course, that there is not enough of it to justify the expense of a power cutter in the average repair shop. However, something can be done about it without



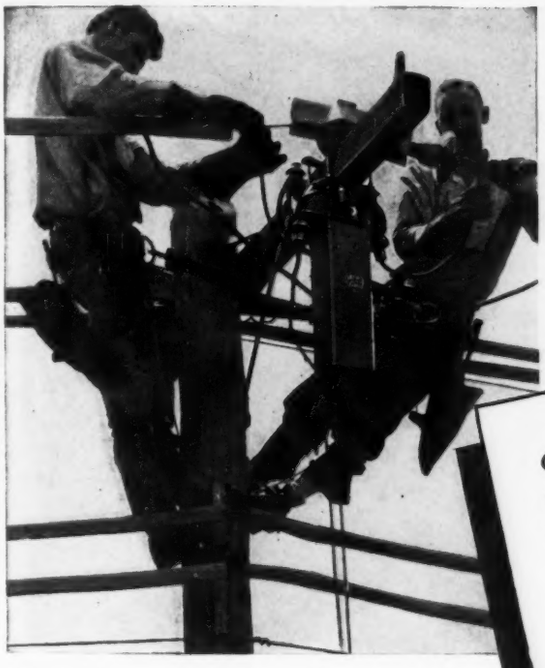
Inexpensive device simplifies task of cutting insulating sheets

spending much money, as is evidenced by the accompanying sketch of a simple cutter devised and built by Pete Grelson, machinist in the apparatus repair shop of the Northern States Power Company in Minneapolis.

This cutter is mounted near the front edge of a sturdy bench and at the back of the bench is a rack in which the rolls of insulating sheet are held one above another so that any kind of sheet desired may be pulled out through the horizontal cutter slot. When the required width of sheet has

These Companies Know

that FP-19 Reclosers Pay for Themselves



in less maintenance
in service continuity
in increased revenue

COMPANY A:
One recloser operated 24 times in two months without a lockout.

COMPANY B:
One recloser operated 15 times in 45 days. Finally a lockout caused by a line falling to the ground.

COMPANY C:
A recloser operated 16 times in one night—no lockouts.

COMPANY D:
Three reclosers. One operated 54 times in two months; one 68 times in three months; and one 50 times in three months.

ALL of these reclosers were equipped with operation counters, and it was easy to tell just how many times they had restored service to customers on rural power lines.

Assuming a cost of only $10 to send out an emergency crew to locate trouble and restore service, these reclosers have made a big saving.

No maintenance was required on any of these reclosers. Except in the case of the fallen line (Company B), service was maintained. So, no revenue was lost. These experiences are typical. General Electric Co., Schenectady, New York.

THEY PAY MOST DURING THE LIGHTNING SEASON

890-34

GENERAL ELECTRIC

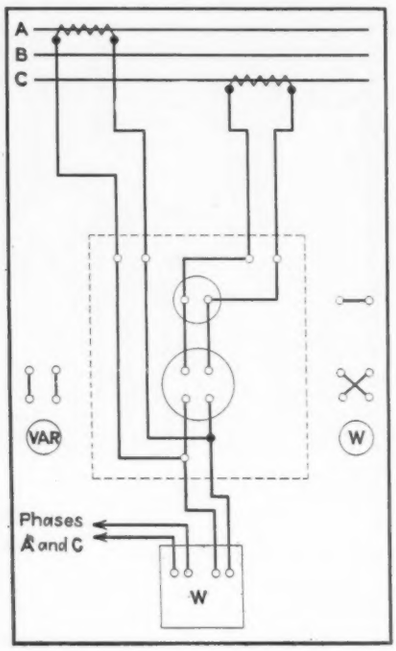
been pulled through the frame is clamped down tightly on it and one stroke of the disk knife cuts it off.

•

Plug Board Aids Getting Reactive Kva.

By G. W. STUBBINGS
Winchester, England

When two cross-connected current transformers are used to measure the power in a balanced three-phase load, the volt-ampers reactive can be obtained by reversing the connections to one of the transformer secondaries. By this reversal the wattmeter is made to carry the third line current, and its reading gives 1/53 of the total "VAR." This method is very useful in field tests on motors, since power factors can be obtained simultaneously with input readings. In applying this method it is usual to change over two leads at the terminals of a portable current transformer, after closing its short-circuiting switch. If, the current transformers are in an awkward position, a more convenient method of changing over connections for "VAR" readings is by the use of the plug board shown.



Plugs facilitate power factor determination

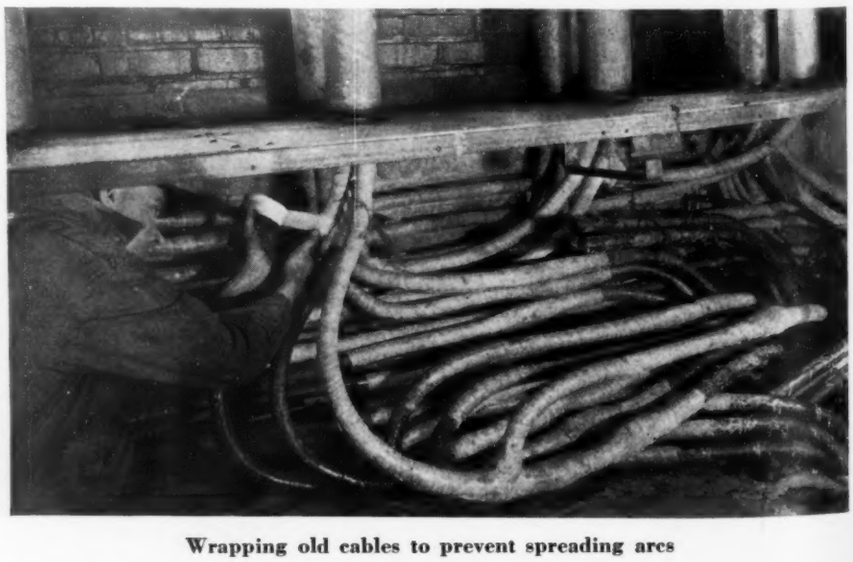
Secondary leads from one transformer are connected to a four-pin plug socket with earthing connection. Two four-pin plugs are provided, having pairs of pins joined together to give either a cross-connection for power readings or a straight parallel connection for "VAR" readings. The difference of the sizes of the main and the earthing pins insures that the plugs will always be inserted in the correct position. A second two-pin socket with a short-circuited plug is provided, and this plug is inserted before the four-pin plug is changed to reverse the transformer connections. The external faces of the plugs can be marked "W" and "VAR," so that it can be seen at a glance which quantity is indicated by the wattmeter. If plugs are inserted into both sockets, both of the current transformer secondaries are short circuited and the current range of the wattmeter can be safely changed over.

•

Fireproofing Old Cables

To confine arcs to cable runs developing heavy grounds or short circuits and prevent the spread of fire to adjacent conductors, the Associated Factory Mutual Fire Insurance Companies, Boston, recommends wrapping cables which have no flame-resistant coverings as follows: The accepted method of fireproofing is to wrap each cable with 2-in. asbestos tape applied with a 50 per cent lap and then thoroughly saturating with a thin solution (sp. gr. 1.15) of silica of soda, or else to use a commercial insulation designed for this purpose. Such wrapping will not prevent arcing and some fire may occur at the arc, but the wrapping on adjacent cables will prevent the spread of fire and will confine the interruption to one or two cables.

Fire-retardant coverings on grouped cables often mean the difference between a major power shutdown and a minor repair job. Although most recent cables are provided with a flame-resistant covering, many older cables with combustible insulation, either exposed or lead covered, form vulnerable "bottlenecks" in the distribution system. The Associated companies recommend that grouped traveling cables, which cannot practically be fireproofed, be purchased with noncombustible coverings.

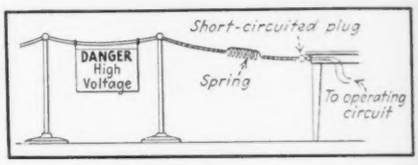


Wrapping old cables to prevent spreading arcs

Fence Controls High-Voltage Test Circuit

When high potential checks are made on rubber gloves and other equipment in the testing laboratory of the meter department of the Union Electric Company of Missouri, St. Louis, use is made of ropes and stanchions to inclose the area temporarily. Permanent fencing is impracticable since the area cannot be reserved for "high pot" tests.

As illustrated in the accompanying sketch this fence is extended from the wall out to the table on which the test control equipment is mounted. On the side of the table is a receptacle in series with the primary of the high-tension transformer. On the end of the rope from the last stanchion is a short-circuited plug. The rope has a spring in it as shown. When the fence is extended to full length the plug does not quite reach to the receptacle, and in order to make the connection the spring must be stretched out. The spring tension is not sufficient to pull out the plug once it is inserted, but it is enough so that any appreciable strain on the rope, as of some one walking into it, will jerk the plug out immediately and open the primary circuit of the testing transformer.



Strain on safety rope opens test circuit

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3—20,000 Kva forced-air cooled, 15,000 Kva self-cooled, 3 phase, 60 cycle transformers.
132,000 volts high to 6600 volts low.

Moloney Serves Steel

THESE Moloney Transformers are doing their bit toward aiding the steel industry to supply the enormous demand for steel. Steel men need dependable transformers to supply the tremendous amount of power required to keep their mills running at top speed . . . that is why they

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Industrial ELECTRIFICATION

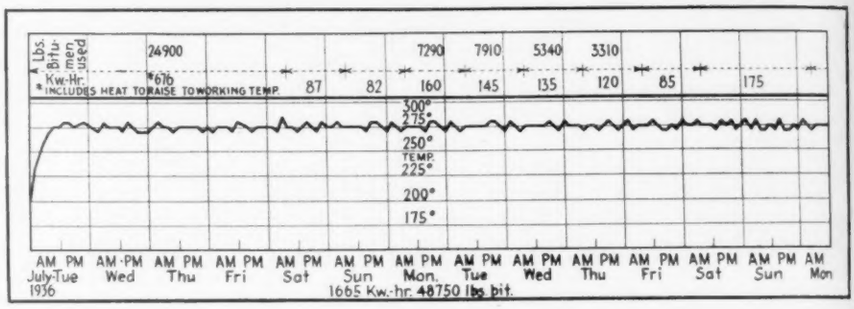
New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Cut Operating Costs With Bitumen Heater

To coat crushed stone properly with bitumen in preparing material for "black top" roads the bitumen must be heated to about 275 deg. F. Steam has been the commonly accepted medium for doing this. However, at the Rock Hill, Pa., plant of the General Crushed Stone Company electricity is being used for heating the bitumen both in the storage tank and the supply tank, from which bitumen is delivered to the mixer.

Use of electricity permits automatic thermostatic control of temperature within a very narrow range, a condition difficult to obtain with steam as the heating medium. Since the heaters keep the temperature of the bitumen constant automatically the need for a fireman or other attendant is done away with.

At the Rock Hill plant the storage tank has a volumetric capacity of 8,000 gal. and an electrical capacity of 18 kw. Bitumen in this tank is maintained at 250 deg. F. The supply tank, which holds 3,000 gal., is equipped with 45 kw. of electric heaters and is filled from the storage tank at the end of the day's run so that the temperature of the bitumen can be raised to 275 deg. in the supply tank during the off-peak period. During operating periods the bitumen is pumped from the supply tank to the mixer by a motor-driven pump. Even with this pumping operation the installation consumes only some 150 kw.-hr. per day. Both heaters were supplied by the Easton Car & Construction Company. They consume from 4 to 5 kw.-hr. per hour per 1,000 gal. of bitumen during non-operating periods to maintain constant temperature.



Variations in temperature of bitumen in electrically heated tank

Figures above the chart show kilowatt-hours consumed and pounds of bitumen delivered from day to day during the two-week test period.

Results of three months operation of the heater shows the following power consumption and bitumen output data:

1.	3,178 kw.-hr.	156,700 lb.
2.	2,965 kw.-hr.	48,610 lb.
3.	3,608 kw.-hr.	115,600 lb.

The accompanying chart shows the variation of temperature during a two-week operating period. During the period represented on the chart 1,665 kw.-hr. was consumed and 48,750 lb. of bitumen was drawn from the heater, at periods indicated on the chart.

•

Read Meter Speeds to Fix Power Factor

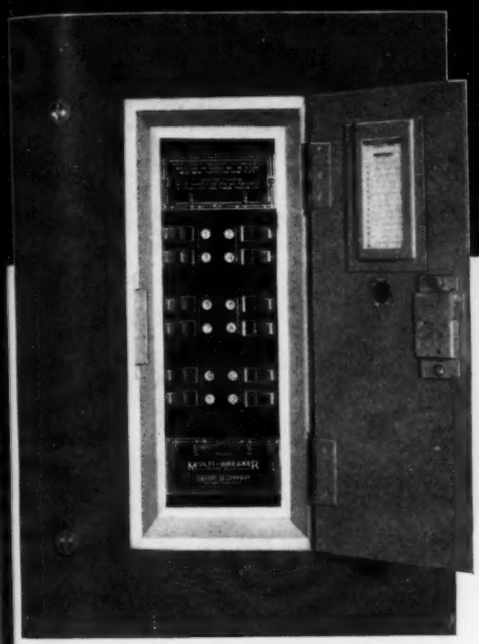
By K. B. HUMPHREY
Sayreville, N. J.

Common practice of utilities is to adjust all or part of a power bill on the basis of the power factor of the load. With a kilowatt-hour meter and a reactive-kvah meter installed the ratio of their monthly readings and also their speeds of revolution at any time show the power factor. The latter principle enables the industrial plant engineer to correct his power factor whenever it is low and there are synchronous motors whose field currents can be adjusted. Only one or two revolutions of the disks need be timed to get a satisfactory index.

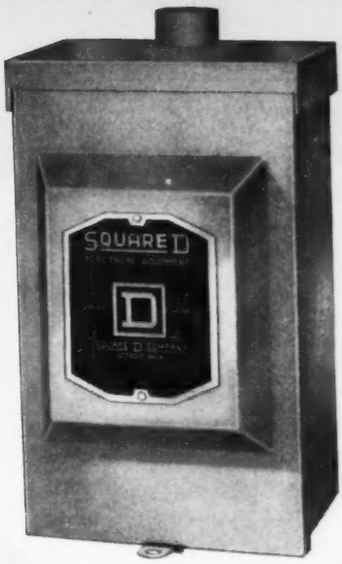
For instance it was desired to find out the power factor when two of the synchronous motors were shut down and only a small load was being used. The power meter turned one revolution in 270 seconds and the reactive meter took 210 seconds for one revolution. The number of seconds is inversely proportional to the kw.-hr. or by dividing the seconds per revolution by 60 gives the revolutions per minute, in this case 0.222 and 0.2857 respectively. Dividing the reactive r.p.m. by the power r.p.m. gave the number 1.282, which when looked up on the chart corresponded to a power factor of 62 per cent. By making adjustments on the fields of the synchronous motors it was possible to adjust the power factor to such a point that the rather low power factor at certain times could be compensated for over the billing period.

A snap test such as outlined can be taken in a very short time and serves as a check on the operators. Sometimes the field current on the synchronous motors will not be adjusted correctly and if the power factor is low due to this cause it will not ordinarily show up until the end of the month.

There is a SQUARE D MULTI-BREAKER for every service



Multi-breakeR
lighting panelboard



Raintight Multi-breakeR

16-circuit Multi-breakeR
load center

● The development, introduction and promotion of the Square D Multi-breakeR has been an important contribution to the electric power industry.

The rapidly growing list of installations will bring a material reduction in service expense to the power companies. Ask your service men.

The convenience of the Multi-breakeR adds to customer good will, encourages the use of more convenience outlets, more electrical appliances, better lighting.

Square D is the only manufacturer who now offers to the power companies a complete line of Multi-breakeRs with which to meet every demand. The line includes:

The inexpensive two-pole unit for the addition of range or water heater circuits to existing wiring.

The standard Multi-breakeR for service entrance and distribution up to eight circuits.

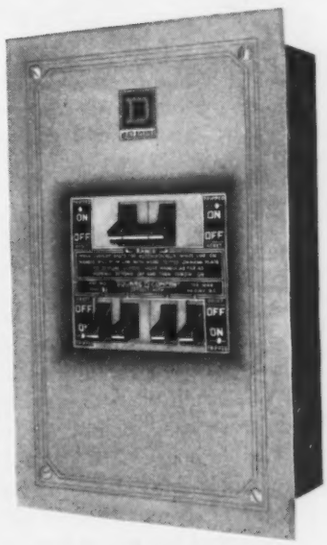
The raintight Multi-breakeR for outdoor installations.

The Multi-breakeR load center, up to sixteen circuits.

The Multi-breakeR lighting panelboards, up to forty circuits for large commercial or industrial installations.

New Bulletin CA-543-A gives complete descriptions.

New low-priced
2-pole Multi-breakeR



Standard Multi-breakeR

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SQUARE D COMPANY CANADA LTD. TORONTO, ONTARIO

CALL IN A
SQUARE D MAN

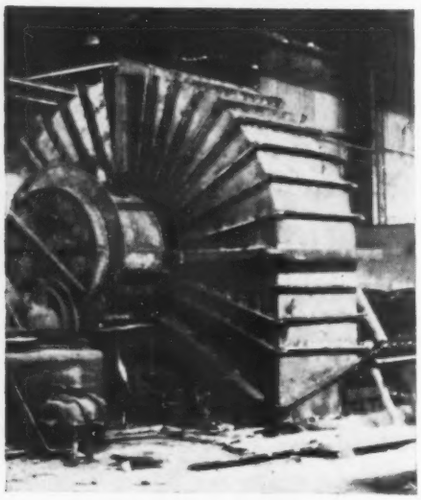
In one case a test brought to light the fact that one of the field ammeters on one particular motor was reading high and when the operator set the field at 20 amp. it was in reality considerably lower.

•

Welding Helps Save Flooded Motor

By HENRY K. DE VRIES
American Murex Company, New York City

During the Ohio River floods in January, 1937, a large part of the property occupied by the plants of the American Steel Company at Newport, Ky., was flooded. Among the machinery submerged was a 3,000-hp. motor that remained under water more than a week. The method used to dry out this motor, in order to fit it once more for service, was not only unusual but also proved highly effective.



Welded housing around 3,000-hp. motor permits application of heat and vacuum to speed drying of wet insulation

The application of any great amount of heat was, of course, out of the question because of certain injury to the motor insulation. It was decided therefore to construct an airtight housing around the motor and employ both heat and vacuum. Because of the greatly reduced boiling point of water under vacuum, it was possible actually to boil out all moisture from the motor at a temperature low enough to be perfectly safe.

A welded steel casing was built around the motor, as shown in the illustration, which was 12 ft. long, 5 ft. wide and had a drum on each side to inclose the shaft. Made of ¼-in., low-carbon steel plate, reinforced with steel bars and I-beams, it was completely electrically welded in place using carbon-molybdenum steel electrodes which had been salvaged from the flood. Despite the fact that these electrodes had been submerged for at least fourteen days they worked well.

Temperature inside the housing was brought up to 150 deg. F. and air was pumped out to establish a vacuum of 28 in. This temperature and vacuum was maintained for a period of three weeks, after which the housing was removed and the motor was found to be thoroughly dryed out.

•

Motor Factory Adopts Combination Lighting

By H. M. HAYS
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

What is perhaps the largest mercury incandescent lighting installation in the country has been made in the new small motor plant of the Westinghouse Electric & Manufacturing Company near Lima, Ohio. More than 600 combination lighting luminaires of a new design have been used in the installation.

Three 150-watt incandescent lamps in these combination luminaires are spaced symmetrically about the "Mogul" socket for the 400-watt high-intensity mercury-vapor lamp and are attached directly to the top of the reflector. The mercury lamp produces 16,000 lumens and three 150-watt incandescent lamps produce 7,740 lumens. Fixtures are mounted 13 ft. from the floor and are spaced on 18-ft. centers. The average intensity of illumination is about 33 ft.-candles.

The distribution system for the lighting load is three phase, four wire. Four copper buses were run the full length of the building and used for both lighting and power circuits. Feeder taps are taken directly from the main bus to the lighting panelboard.

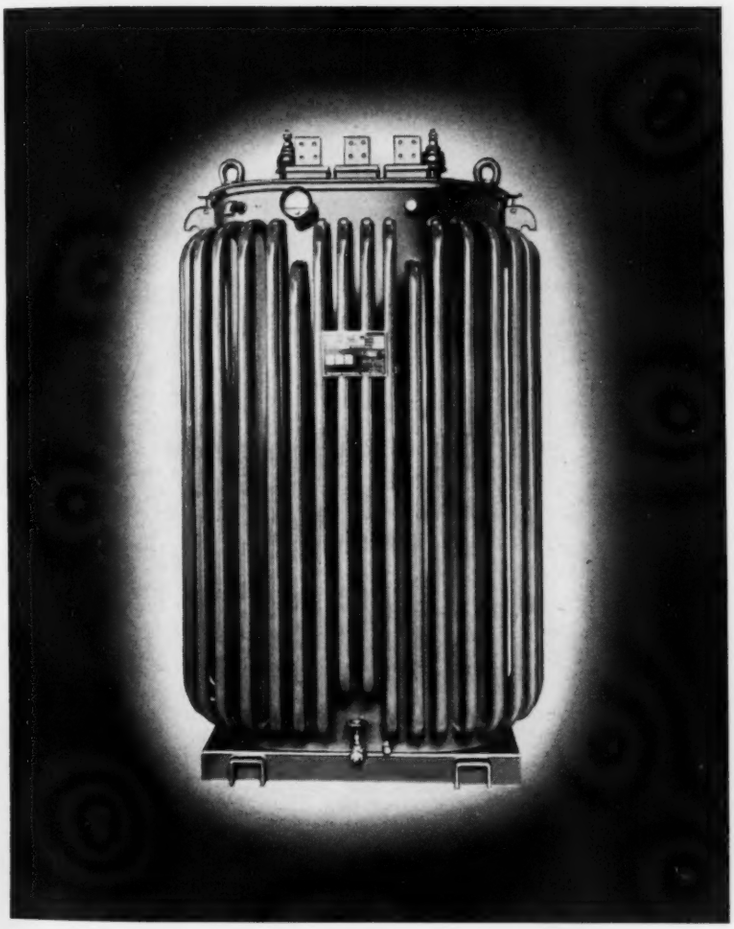
Since separate switching was desired for both types of illumination it was necessary to use two-pole breakers for the mercury lamps and single-pole breakers for the incandescent lamps. The 115 volts for the incandescent circuit was obtained from phase to neutral and the 199 volts for the mercury-vapor lamp transformers from phase to phase.

Ballast equipment for the mercury lamp is a high power factor transformer capacitor unit with line taps for 190-199 and 208 volts. A condenser of sufficient capacity to give power factor from 90 to 95 per cent was mounted in each case. Two types of transformers cases were used—suspension cases with the lighting unit mounted directly below it and wall-mounted cases where the transformer is to be mounted directly on the ceiling. The latter type has been found especially useful in conserving mounting height.

Combination luminaires yield 33 ft.-candles in motor factory

Single 400-watt mercury lamp and three 150-watt incandescent lamps in units spaced on 18-ft. centers and mounted at 13 ft. provide ample illumination in winding department.

Here is what we have to say ABOUT TRANSFORMER BUILDING



A transformer is an expensive piece of electrical apparatus. As one of the fixed cost factors of your business it is necessary that it can be depended upon to render years of efficient operating service.

STANDARD transformers are not manufactured on the ordinary production line basis, but, instead, are built by groups of experienced workmen assigned to work on one particular order until it is completed.

This method of procedure fixes the responsibility for each operation on a certain man. Naturally, these men, knowing that they are responsible for the success or failure of the job, take pride in the quality of their work. They exert that extra attention to detail which later becomes apparent in the prolonged life and trouble free operation characteristic of all STANDARD transformers.

As the demand for more distribution facilities is increasing daily, it is important that promised deliveries be met on schedule. The flexibility of our manufacturing system makes attractive delivery dates possible.

For complete description of STANDARD DISTRIBUTION AND POWER TRANSFORMERS and the methods used in their construction . . . write for our Bulletin S-401.

Standard

TRANSFORMER COMPANY

Manufacturers

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New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Sawdust Digger Cuts Cost, Promotes Safety

By L. O. B. LINDSTROM
General Electric Company,
San Francisco

In many places, particularly lumber mills, sawdust and hog fuel is used for power production. It is a well-known fact that, due to its weight, this fuel packs to such a density that it is necessary to break down the sides with a pike pole and pick. As this fuel is generally stored in large fuel bins or houses this process makes it necessary for men to get down along the side of the fuel pile, where they are in constant danger from suffocation should a slide occur. Many such fatalities have thus occurred. In addition to the danger, the progress of breaking down a pile is exasperatingly slow and, accordingly, labor cost is high.

To improve these conditions Paul Peterson, master mechanic of the Long Bell Lumber Company, originated a power sawdust digger which is shown in the accompanying illustration. It is a combination of traveling crane, power shovel and dredge. The travel consists of a track running from one end of the fuel house to the other, under which are the conveyor chains which receive the fuel broken down and carried to it by the machine's digger chain. The latter chain is part of a boom long enough to reach the sides of the fuel house and is equipped with spikes which readily break the solid packed sawdust loose and carry it to the central conveyor. The machine is propelled back and forth along the track by means of a motor-driven winch. It will be noted that the operator's cabin is protected by steel plates so that should a slide occur he will have ample air until the digger can be hauled out of the fuel house. The electrical layout was designed by Harvey Gilman, chief electrician of the company.

Analysis of Steam Plant Performance

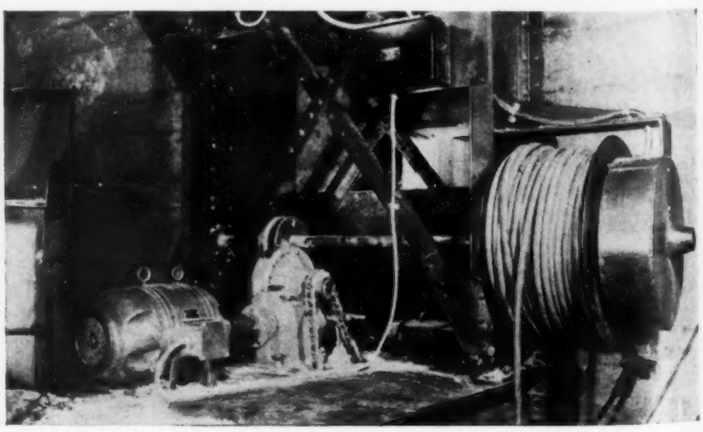
For analyzing steam plant performance, R. H. Parsons develops the formula (*The Engineer*, Aug. 20, 1937):

$$H = a + K\left(b + \frac{c}{L}\right), \text{ in which}$$

H = Annual heat consumption in B.t.u.
K = The corresponding annual output in kw.-hr.
L = Annual load factor.
a, b and c are constants characteristics for each of the plant. These can be determined when figures are available for the station performance for three equal periods of time, as an example, a station used for which the following figures are available:

Year	Output in Millions of Kw.-Hr.	Load Factor per Cent	Efficiency per Cent	Heat Consumption in Millions of B.t.u.
	K	L	E	H
1933	365	40.4	21.15	5,888,320
1934	396	44.6	21.42	6,307,899
1935	413	43.9	21.45	6,659,490

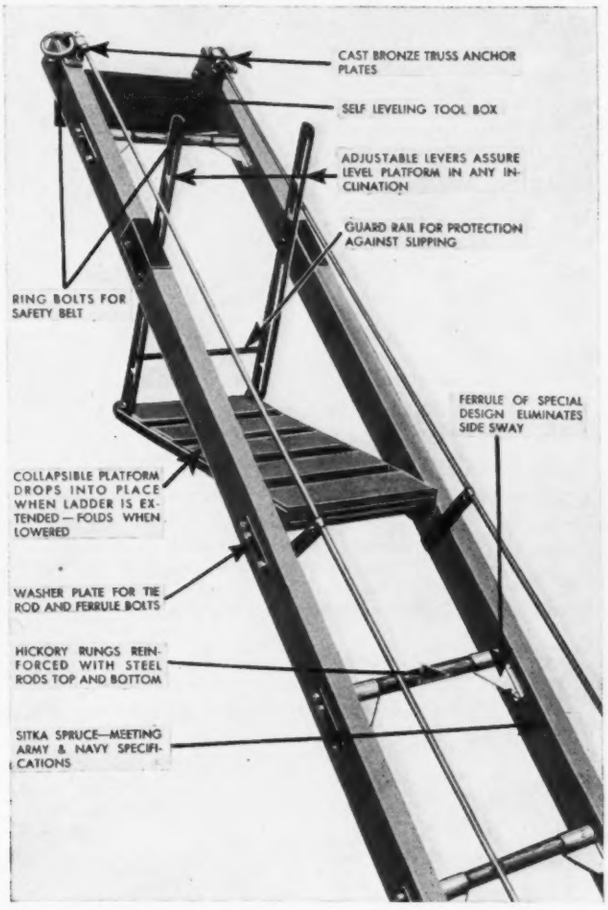
By substituting the values of K, L, and H for each year respectively in the above equation, three simultaneous



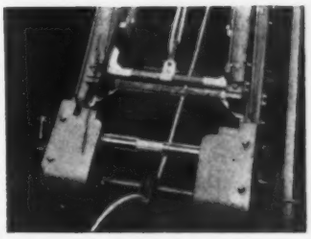
Motored sawdust digger removes stored fuel with maximum safety and minimum cost

The various motions are individually powered with electric motor-driven speed reducers, such motions being the digger chain drive, boom hoist and lower, the boom swing and the travel. Three-conductor tellurium cable reeled and unreeled. Drum is positively driven from the travel gear and chain mechanism.

BOTH AUTOMATIC IN OPERATION . . .


CAST BRONZE TRUSS ANCHOR PLATES
SELF LEVELING TOOL BOX
ADJUSTABLE LEVERS ASSURE LEVEL PLATFORM IN ANY INCLINATION
GUARD RAIL FOR PROTECTION AGAINST SLIPPING
RING BOLTS FOR SAFETY BELT
FERRULE OF SPECIAL DESIGN ELIMINATES SIDE SWAY
COLLAPSIBLE PLATFORM DROPS INTO PLACE WHEN LADDER IS EXTENDED — FOLDS WHEN LOWERED
WASHER PLATE FOR TIE ROD AND FERRULE BOLTS
HICKORY RUNGS REINFORCED WITH STEEL RODS TOP AND BOTTOM
SITKA SPRUCE—MEETING ARMY & NAVY SPECIFICATIONS

WORKING PLATFORM AND LATCHING



When the ladder is lowered to the "A" frame, locking pins automatically enter the inclination holes, thus providing automatic latching.

One of the most significant improvements in the MURRAY Demountable CROWSNEST is automatic operation of the working platform as well as the latching.

The collapsible platform provides a guarded floor from which the operator can work with a feeling of security and freedom.

As the upper section is extended, the platform, of itself, opens to working position *automatically*. When job is complete and upper section is lowered the platform folds *automatically*.

Erection is extremely fast—it's one-man operated—and "spotting" is obtained with little exertion to operator.

This new improved CROWSNEST is thus more speedily operated — has greater tractability. Complete construction and operating details disclosing its durability and utility are given in a 20 page bulletin. Write for a copy.

Put a MURRAY Demountable CROWSNEST to work and watch maintenance expense drop.

METROPOLITAN DEVICE CORP.
1250 Atlantic Ave., Brooklyn, New York

MURRAY CROWSNEST

DEMOUNTABLE

equations are obtained, the solution of which gives the numerical values of the constants *a*, *b* and *c*. Inserting these values, equation becomes:

$$H = 390{,}946 \times 10^6 + K\left(13{,}792 + \frac{51{,}280}{2}\right)$$

From this equation it is possible to predict what heat consumption and consequently what thermal efficiency the station might be expected to have when working with any assigned output and load factor. But the author carefully adds: "Provided, of course, that it continued to 'run true to form.'" He also adds: "Regarding changes of load factor alone, it will be seen that these have relatively small influence on the efficiency."

•

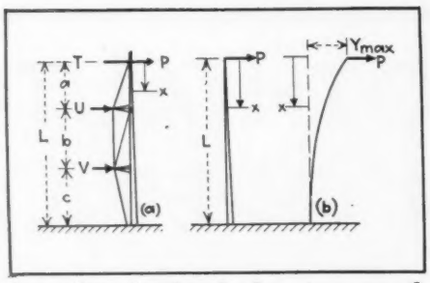
Truss-Guyed Pole Reduces Deflection

By LEONARD V. SMOOT
Cincinnati Gas & Electric Company
Cincinnati, Ohio

The truss-guyed pole is a compromise installation developed by the theoretical engineer to satisfy the practical construction engineer, who cannot imagine a corner in a pole line or a dead-end pole without some kind of a guying arrangement.

While its relative merits are open to question, it must be admitted that the truss-guyed pole has some advantages over the unguyed pole as far as deflection is concerned. If it is necessary to reduce deflection in the structure, the truss-guy is a practical way to accomplish the desired results. However, if the amount of deflection is immaterial, there is very little point in resorting to this type of structure.

The strength of a truss-guyed pole is increased very little over that of an unguyed pole. In no case investigated by the author has it been increased over 10 per cent. However, the stiffness is increased considerably, the increase varying with the size and arrangement of the guys and struts.



Formulas developed for truss-guyed pole

1. The stiffness of the pole increases the load to be sustained, but, due to the deflection even in this type of structure, the ultimate load sustained is always less than it would be if the structure were perfectly rigid.
2. The increase in strength is practically negligible.
3. By arrangement of the struts and guys the loads may be changed to such an extent that the permanent distortions set up in the pole may become very unsightly.
4. The structure is statically indeterminate and does not lend itself to simple design. Assumptions must be made that only experience with such structures can obviate.

With these facts in mind, a solution is given. The arrangement of the guy and struts shown is the simplest arrangement usually encountered.

The fundamental equations of work are used for the solution, and the work in each of the integral parts of the structure is summed up in a general equation involving the following general equations.

Work due to bending $(W) = \int_0^L \frac{M^2 dx}{2EI}$

Work due to direct tension and compression

$$(W) = \frac{K^2 L}{2AE}$$

in which M = moment on pole in pound inches
E = modules of elasticity in pounds per square inch
I = moment of inertia in inches^4
K = direct stress in pounds
L = length of member in inches
A = area of member in square inches

and $$I = \frac{\pi}{4}(r + tx)^4$$

in which r = radius of pole at top of section in inches
t = taper of pole in inches per inch
x = distance from top of section to point under consideration.

By setting up the equation for total work in the whole structure, then differentiating with respect to the unknowns appearing in the equation and setting the differential equation equal to zero, the values of the unknowns may be found by solving the resulting set of simultaneous equations.

The suggested method of the solution will give integrals as coefficients of the unknowns. These integrals may be evaluated for various sizes and lengths of poles commonly used on the system.

As soon as the values of the loads have been found for the structure, the next step is to determine the deflection due to the loading.

The general condition of loading is shown in lb. Deflection is found for each load by applying the general slope deflection equation.

$$EI\frac{d^2y}{dx^2} = -Px$$

in which all symbols have the same meaning as before.

By solving this equation it is found that

$$Y\max = \frac{424\,Pl^3}{Er\,R^3}$$

and $$\frac{\Delta p}{dx} = \frac{4\,PL^2}{E\,(R-r)^2}$$

$$\left[-\frac{1}{2(r+tx)^2} + \frac{r}{3(r+tx)^3} + \frac{1}{2R^2} - \frac{r}{3R^3}\right]$$

in which R = Radius of the pole in inches at the bottom of the pole.

By applying these two equations the deflection at any point on the pole may be determined.

The deflection will be found to vary from a minimum to a maximum, depending upon the size pole, the taper, the arrangement of the struts and the size guy used.

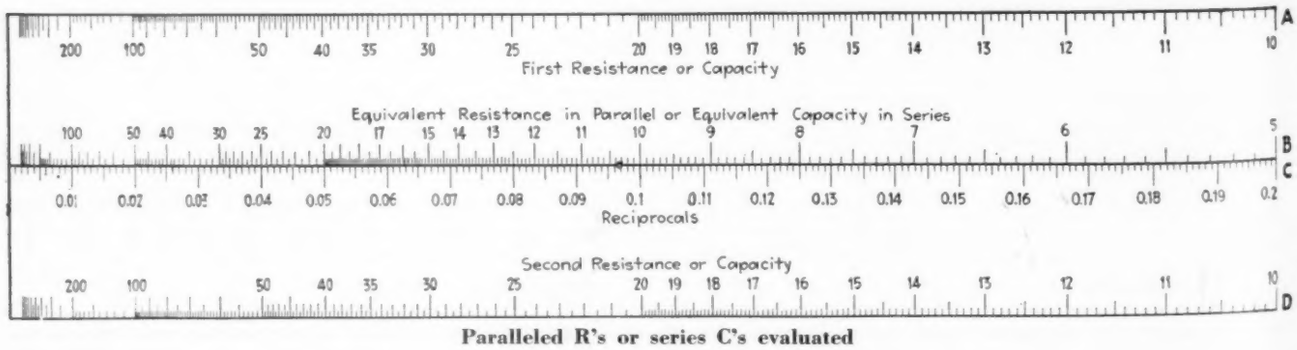
The solution given here is a condensation of extensive mathematical analysis of the problem.

•

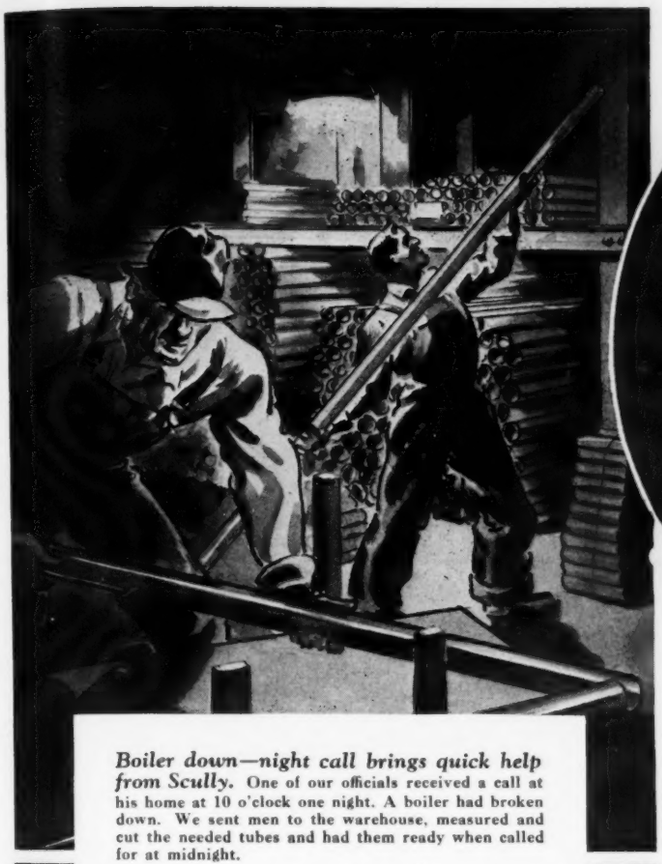
Nomogram Evaluates Parallel Resistances

By D. J. WILLIAMS
Birkenhead Institute High School, England

A nomogram for determination of the resultant values of resistances in parallel (or capacitances in series) is readily developed by application of the principle of addition of reciprocals. The scales as shown are placed equidistant from the resultant scale. A straight edge placed in the A and D scales gives at the B scale the resultant value. The reciprocal scale C is incidentally useful in obtaining directly tthe reciprocals of the values (on the B scale) from 5 to 100.



Paralleled R's or series C's evaluated



Boiler down—night call brings quick help from Scully. One of our officials received a call at his home at 10 o'clock one night. A boiler had broken down. We sent men to the warehouse, measured and cut the needed tubes and had them ready when called for at midnight.

"We must have it in the morning." Another emergency call came to us at 9 o'clock one night. Some Stainless Steel was needed for a rush job. We cut and delivered the order early the next morning.

IN EMERGENCIES TOO -call Scully

WHEN an emergency calls for steel or steel products in a hurry, prompt service will save you many dollars. When such an occasion arises, call Scully. We will meet that emergency.

And call Scully, too, for your regular requirements. We have huge stocks of steel, steel products, copper and brass in eight conveniently located warehouses. Try us.

Phone, write or wire the Scully warehouse nearest you. And send for our handy, complete Stock List and Reference Book. It's free, of course.

YOU'LL LIKE *Scully Service*

SCULLY STEEL PRODUCTS CO.

Warehouses at

CHICAGO • BOSTON • PITTSBURGH • NEWARK, N. J. • ST. LOUIS
BALTIMORE • ST. PAUL • CLEVELAND

UNITED STATES STEEL

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Boston Analyzes Range Trouble Calls

Boston Edison Company's vigorous promotion of electric range sales throughout its territory during 1936 led its distribution department to analyze the major causes of range service trouble for the purpose of locating weak spots in design and installation. Last year some 2,371 domestic ranges were installed in the territory, of which 269 replaced existing outfits, leaving a net addition of 2,102, according to the installations department's record. The company estimated that about 30 per cent of the ranges on the system were "In Guarantee"; *i.e.*, that the one-year guarantee period of the manufacturers had not expired.

The analysis covered 7,860 active electric ranges and the tabular record shows the breakdown of various kinds of repairs executed as a result of trouble calls. These are given in the accompanying table in percentages of each type of trouble occurring on ranges within and past the guarantee period, and also the ratio of troubles per 100 ranges per year for five different manufacturers and the total of all groups.

Outstanding causes of trouble were surface units which failed and mechanical failures due to doors out of order, panel defects, loose bolts and poor leveling of ranges during installations. The ranges still on guarantee were responsible for more than half the total troubles studied in connection with pilot light and temperature indicators, timers, mechanical and thermostat control and associated relays.

With the ranges in longer service pilot lights, thermostats, mechanical features and timers gave much less difficulty, emphasizing the importance of reaching routine service adjustments as early as possible in range applications. It was notable that nearly half the troubles of all ranges per 100 in service were due to thermostat and mechanical difficulties.

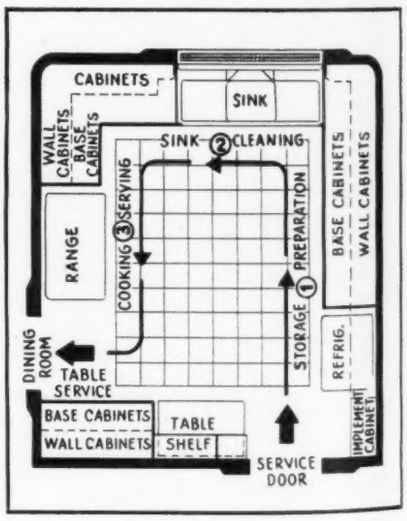
Analysis of 6,292 Repairs Made by Boston Edison on 7,860 "Active" Ranges During 1936

Type of Repair	Per cent of total troubles	Per cent of repairs on "in guarantee" ranges and parts	Trouble Rates Troubles per 100 Ranges per Year					
			Make No. 1	Make No. 2	Make No. 3	Make No. 4	Make No. 5	All makes 7,860
Mechanical troubles—Leveling panels, door adjustments	20.3	54	17.2	11.4	20.4	20.0	24.0	16.1
Wiring trouble	13.4	27	11.7	5.8	7.3	10.0	18.5	9.5
Switch trouble	11.5	18	9.2	15.4	2.8	8.6	9.1	9.2
Thermostat control and associated relays	8.6	49	8.0	5.1	3.8	7.1	14.8	6.9
Surface units	31.5	22	19.4	26.6	32.4	40.1	34.4	25.3
Oven units	6.6	23	5.4	4.2	2.9	8.5	5.9	5.3
Timers	4.5	58	3.9	2.2	3.4	4.3	8.9	3.5
Pilot lights and temperature indicators	3.1	70	3.0	1.5	0.3	3.1	6.5	2.5
Miscellaneous	0.5	35	3.1	0.2	1.5	0.5	2.6	1.7
All trouble	100	34	81.0	72.5	74.8	102.2	124.7	80.0

The actual number of troubles repaired was 6,292, and these were broken down as follows for the 7,860 ranges:

Surface units	1,984	Terminal connections	172
Switches	725	General tightening of bolts and leveling	165
Lead wires to switches	497	Relays	110
Thermostat controls	433	Receptables for clock outlets	94
Door repairs	433	Attachment cord and plug	80
Oven units	415	Thermal insulation	19
Miscellaneous mechanical parts	395	Miscellaneous	49
Clock control	275		
Outer panels	248		
Pilot lights and temperature indicators	198		

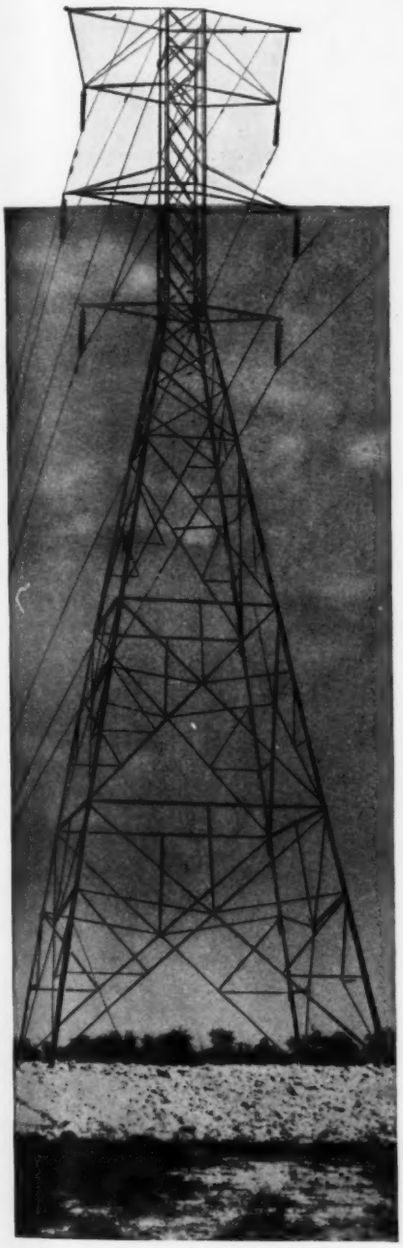
The differences in trouble ratios between the several makes of ranges are significant, and another year's operations will doubtless reveal decided changes in these ratios as designs are studied and improved.



MEAL MILEAGE—In a two-color folder sent out with the monthly invoices of the Connecticut Light & Power Company, this phrase is coined to express the distance the housewife travels in preparing a meal. Designed as a kitchen modernization promotion piece, the folder tells of one modernization plan which reduced "Meal Mileage" from 1½ miles to approximately ¾ mile. The properly planned kitchen reproduced here from the center spread of the folder indicates the three working centers.

Switch your Power Load to

AMERICAN BRIDGE TOWERS



These illustrations show a well-designed river crossing unit (left tower, suspension type, 128 ft. high; right, strain type, 93 ft. high) carrying 6 conductors and 2 ground wires for a 154 k.v., two single circuit electric transmission line.

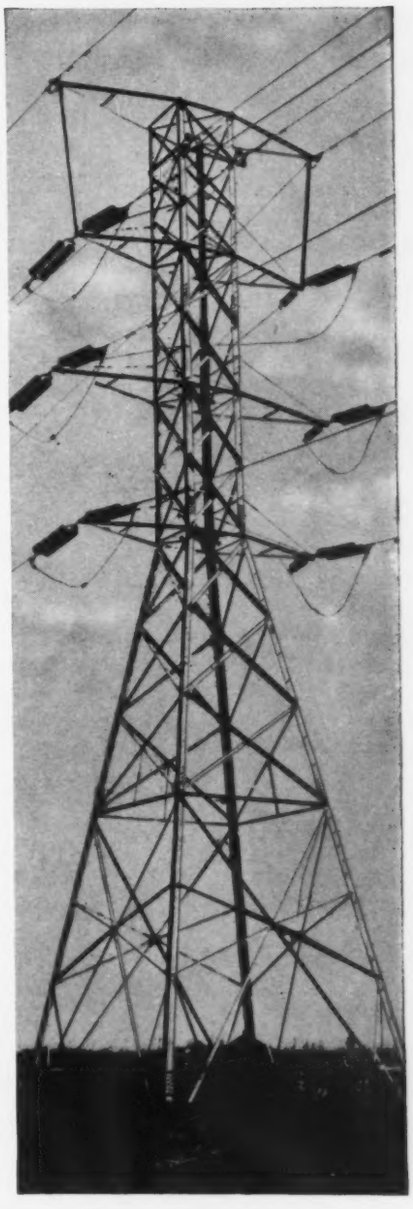
STEEL transmission towers were new, different, practically untried in 1905 when American Bridge Company engineers built their first for the line from Gainesville, Ga. to Atlanta. Thousands of experimental dollars were at stake.

But they were built with confidence! Each step had been carefully worked out, thoroughly pre-tested by these engineers. They knew, with reasonable certainty, that permanently lowered maintenance costs and improved continuity of electrical service would result.

That was 32 years ago! Today, American Bridge Engineers draw upon a remarkable background of experience. They have constructed towers for every character of terrain, weather and service. They have developed many patented features, largely responsible for a more effective, more economical construction of America's power network.

Many electrical engineers have made full size tower tests at American Bridge's proving grounds under loading technique duplicating field conditions. Most electrical engineers have watched American Bridge Towers withstand the tests of 10, 20 and even 30 years of service.

Switch your power load to American Bridge Towers. The same staff responsible for the efficient, economical construction of many of today's major transmission line projects, backed by the entire resources of American Bridge, is available to you for any tower project, under any conditions, at any place and at any time.



AMERICAN BRIDGE COMPANY

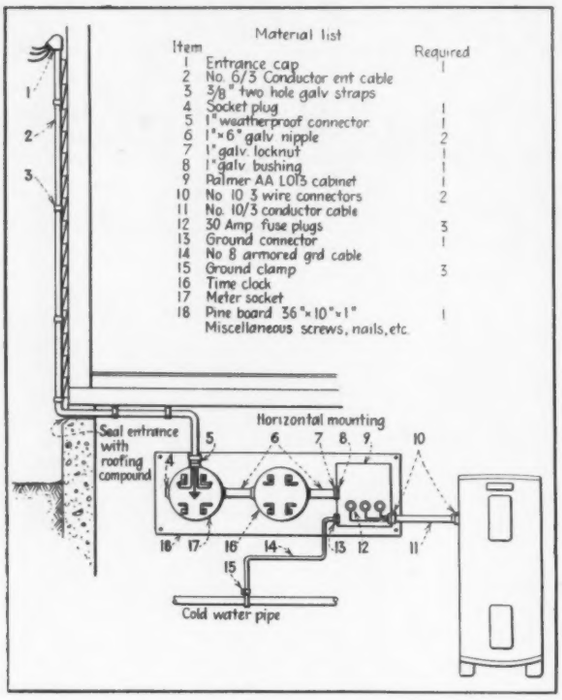
General Offices: Frick Building, Pittsburgh, Pa.

Baltimore Boston Chicago Cincinnati Cleveland Denver Detroit Duluth Minneapolis New York Philadelphia St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

CUTS TRIAL INSTALLATION COSTS


Material list
Item
Required
1 Entrance cap 1
2 No. 6/3 Conductor ent cable
3 3/8" two hole galv straps
4 Socket plug 1
5 1" weatherproof connector 1
6 1"×6" galv nipple 2
7 1" galv. locknut 1
8 1" galv bushing 1
9 Palmer AA 1013 cabinet 1
10 No 10 3 wire connectors 2
11 No. 10/3 conductor cable
12 30 Amp fuse plugs 3
13 Ground connector 1
14 No 8 armored grd cable
15 Ground clamp 3
16 Time clock
17 Meter socket
18 Pine board 36"×10"×1" 1
Miscellaneous screws, nails, etc.
Horizontal mounting
Seal entrance with roofing compound
Cold water pipe

This shop assembly of wiring and equipment, used by the Wisconsin Power & Light Company for trial installations of electric water heaters, cuts about in half the cost of electrical installation and of possible removal. Meter, time switch and service cabinet are assembled and wired on a board and installed as a unit on the customer's premises. Unit assembly is used when service entrance and meter of customer is in attic or other place inconvenient for location of water heater service equipment. Installation requires about four man-hours. —L. A. FALK, Merchandise Sales Manager.

Soil Sterilizer Uses 25 Kw.-Hr. per Yard

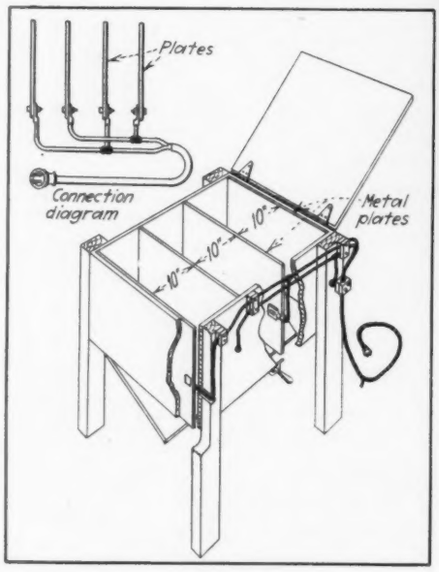
By J. C. SCOTT
Agricultural Engineer
Puget Sound Power & Light Company
Seattle, Wash.

Soil sterilization by electricity has been adopted by the Park Department of the city of Bellingham, Wash., as a means of increasing the beauty of its lawns and gardens. The program of the department includes the sterilization of all soil used in the greenhouses, the compost, which is sprinkled over the greens of the city golf course and, finally, the sterilization of all of the 4 in. of top soil to be placed on the Bellingham Lawn Bowling Club's greens at Cornell Park.

As each of the bowling greens will be 130 ft. square, approximately 400 cu.yd. of sterilized soil will be required for the project. Using the electric soil sterilizer developed by C. W. Wildebour of the Agricultural Engineering Department, Puget Sound Power & Light Company, soil sterilization goes on with two six-hour shifts per day. The sterilizer, having a 1 cu.yd. capacity, raises that amount of earth to a temperature of 180 deg. in two hours. Thus the daily output of sterilized soil is 6 cu.yd.

The average current consumption required for sterilizing each cubic yard is 25 kw.-hr. A total of 10,000 kw.-hr. will be used for sterilizing the 400 cu. yd. for the new bowling green.

Sterilizer operates on 240 volts and has five different speeds, the "speeds" being obtainable by lengthening the distance between the electrodes, making a longer path for the current through the soil. The electrodes are arranged in the sterilizer box so that the loading can be accomplished by operating a switch. When the load reaches 90 amp. the circuit is broken by a Deion circuit breaker switch and the machine is set for the next speed.



Electric soil sterilization
Developed by Puget Sound Power & Light Company and similar to that used by the Park Department of the city of Bellingham, Wash.

Air Conditioning Helps Prevent Colds

Thanks to air conditioning, according to Peter J. Niemann, exchange hall supervisor, Board of Trade members and employees came through Chicago's near epidemic of pneumonia, influenza and common colds with a health record nearly 100 per cent perfect.

"On the trading floor in the old building there were heat prostrations every summer," Mr. Niemann added. "We have had none here in the seven years' use of our year 'round system."

Exposure to respiratory diseases is a maximum in the Pit, center of the world's grain trading, where 800 buyers and sellers crowd close to each other for hours. The traders work in a man-made atmosphere, filtered to the last degree of cleanliness, then warmed and humidified or cooled and dried.

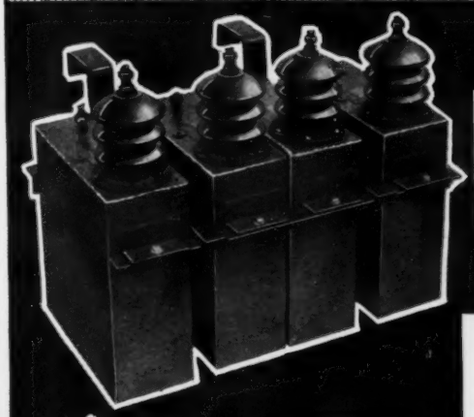
The Air Conditioning Manufacturers' Association describes the Chicago Board of Trade case as one of the most graphically illustrative health-control examples in its records of installations throughout the country.

HOME ON THE RANGE

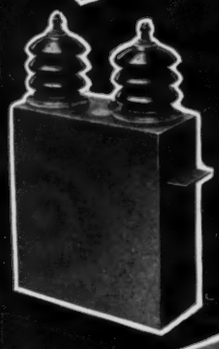
Boston Edison features its store managers' days this fall by offering merchandise specials on selected Saturdays at its 33 electric shops and delivering free electrically cooked luncheons and dinners to the homes of winning attendance card registrants at its lecture demonstrations. Mrs. W. F. Mountfort of Somerville is pictured receiving one course of a prize luncheon from Miss Pauline Poulsen of the company's Home Service staff, who is making a quick delivery from her car of a hot meal prepared at the nearest Edison shop. Who wonders that electric cooking is a focal point of interest in the territory on these promotional sales days!

Rigging Feeders for more KW Hours

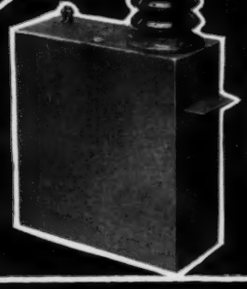
with CORNELL - DUBILIER POLE-TYPE CAPACITORS for POWER-FACTOR CORRECTION on distributing systems.



Four 15 kva units mounted on multiple cross-arm mounting bracket.



2300, 4000 and 4600 volt, two-bushing, 15 kva pole mounting unit. May be mounted singly or in groups with pole-mounting brackets.



2300, 4000 and 4600 volt, single bushing, 15 kva pole mounting unit. One terminal grounded to case.

A few of the outstanding features that make these efficient, easily mounted, flexible capacitors ideal units to use on power lines are:

- **Impregnated and filled with non-inflammable and non-explosive DYKANOL.**
- **Sturdy and superior construction, based on more than twenty-seven years of experience in the exclusive manufacture of capacitors.**
- **Rugged, extra large, glazed porcelain insulators, with three petticoats, assure protection against flash-over dangers and damage due to handling in the field.**
- **Extra strong welded steel case, protected by two coats of weather-proof paint.**
- **Special design allowing for air cushioning of expansion and contraction.**
- **Standard Mounting dimensions.**

Cornell-Dubilier pole-type capacitors have proven most effective and economical for power-factor correction and voltage regulation on distributing systems.

Typical example of tremendous savings effected by power-factor correction toward voltage regulation:

A large public utility recently found it necessary to boost system capacity; cost of added generating and sub-station equipment would have been .....$40,000.00 Investigation proved that similar results could be obtained by a capacitor installation costing only $7,000. Net savings. . . .$33,000.00 Investigate this low cost method of adding KW capacity to your system. C-D engineering field offices throughout the United States will gladly cooperate with you in planning your requirements. Full technical data supplied on request.

WORLD'S LARGEST AND OLDEST MANUFACTURER OF CAPACITORS

CORNELL-DUBILIER

Electric

CORPORATION

South Plainfield, N. J.

CORNELL-DUBILIER ELECTRIC CORPORATION EW 1923
SOUTH PLAINFIELD, N. J.

Please have your representative call ☐ send catalog ☐

Name.....

Address.....

City.....*State*.....

News ABOUT PEOPLE

Naugle Pole & Tie Elects New Executive Officers

Omar C. Curtis has been elected president of the Naugle Pole & Tie Corporation, Minnesota corporation, which recently took over the business and plant of the Delaware company of that name. James H. Rodger is vice-president, Volney S. Nyquist, treasurer and Laur J. Walden, secretary.

For many years prior to 1926, Mr. Curtis was associated with The MacGillis & Gibbs Company of Milwaukee. In 1928 he affiliated himself with Naugle Pole & Tie Company in the capacity of western manager with offices at Spokane, Wash. Following the death of the president, W. L. Lafean in 1935, Mr. Curtis transferred his interests to the east, becoming vice-president and general manager of the Delaware corporation. He acted

O. C. Curtis

in that capacity until the formation of the present corporation.

In addition to performing the duties of vice-president, Mr. Rodger will be sales manager. He became manager of the Chicago office of Lindsley Bros. in 1924, at that time large distributors of poles. Later he was district manager of the Chicago office in charge of all sales for the American Creosoting Company, a position he held for four years. Because of his wide experience, he was appointed special field representative covering ten midwestern states for the General Electric Supply Corporation with headquarters in Chicago and acted in that capacity until joining Naugle Pole & Tie Company in 1936.

J. H. Rodger

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▶T. O. SWEATT has resigned from the staff of Gibbs and Hill, consulting engineers, New York, N. Y., and is now connected with the Public Service Electric & Gas Company, Newark, N. J.

▶R. W. DRUSHELL, distribution engineer, Ohio Public Service Company, Alliance, has been transferred to the Elyria offices of that company.

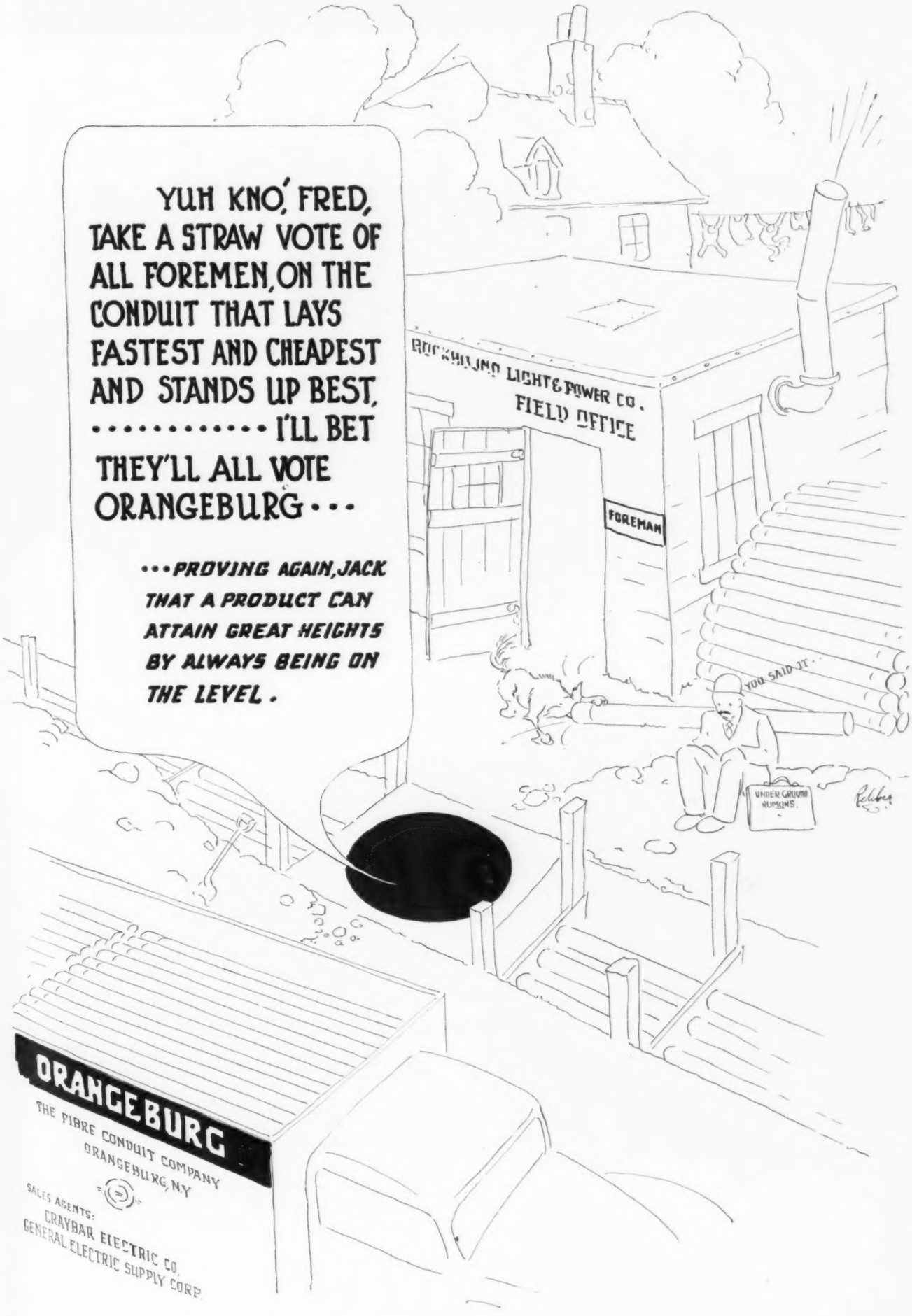
▶GLEN H. TRESLAR has been appointed assistant sales manager of the Black & Decker Manufacturing Company. Mr. Treslar has been connected with the organization for more than fifteen years in the capacities of territorial salesman, territorial branch manager and more recently as supervisor of the Cleveland and Detroit areas. He will have his headquarters at the company's home office at Towson, Md., assisting Robert D. Black, sales manager.

▶A. R. JOHNSON has been appointed manager of the merchandising sales division of Cutler-Hammer, Inc., Milwaukee, Wis. Mr. Johnson will be in charge of all distributor activity.

▶RUSSELL W. AYERS, since 1929 a member of the refrigerator engineering staff of the General Electric Company, has been appointed chief engineer of the refrigerator division of the Stewart-Warner Corporation, Chicago. Mr. Ayers has been continuously engaged in electric refrigerator design and research since 1925, when he became chief engineer of the refrigerator division of the Savage Arms Company. Previous to that time, he was on the engineering staff of Yale & Towne Manufacturing Company.

▶WAYNE H. GEIGER has been apponted superintendent of the electric distribution department of the Bergen division of the Public Service Electric & Gas Company of Newark, N. J. Mr. Geiger has been assistant superintendent of the division since 1919. Promotion of Raymond T. Moock to succeed Mr. Geiger as assistant superintendent of the Bergen division has also been announced. Mr. Moock has been superintendent in the Paterson district of the company since 1935.

▶E. ARTHUR BALDWIN, vice-president and general European manager of the International General Electric Company, has been awarded the decoration of Officer of the Legion of Honor in recognition of his many services to France. Mr. Baldwin is president of the American Chamber of Commerce in France, a position he has held since 1934. He served as a member of the


YUH KNO, FRED, TAKE A STRAW VOTE OF ALL FOREMEN, ON THE CONDUIT THAT LAYS FASTEST AND CHEAPEST AND STANDS UP BEST, ... I'LL BET THEY'LL ALL VOTE ORANGEBURG...
...PROVING AGAIN, JACK THAT A PRODUCT CAN ATTAIN GREAT HEIGHTS BY ALWAYS BEING ON THE LEVEL.
ROCKLAND LIGHT & POWER CO.
FIELD OFFICE
FOREMAN
YOU SAID IT
UNDERGROUND RUMORS.
ORANGEBURG
THE FIBRE CONDUIT COMPANY
ORANGEBURG, NY
SALES AGENTS:
CRAYBAR ELECTRIC CO.
GENERAL ELECTRIC SUPPLY CORP.

monetary committee of the International Chamber of Commerce in 1934 and has participated in International Labor Conferences held in Geneva as a representative of the United States Government. Mr. Baldwin is a director of several European electrical manufacturing companies. Before going to France he was manager of the Schenectady office of the International G. E. Company.

► L. A. BALTZELL, formerly connected with the meter test section of the El Paso Electric Company, has been transferred to the Texas-New Mexico Utilities Company as superintendent of the meter department with headquarters at Plainview, Tex.

► W. D. A. PEASLEE, consulting engineer, Indianapolis, Ind., has joined the staff of W. S. Dickey Clay Manufacturing Company, Kansas City, Mo., as chief engineer. Among Mr. Peaslee's former connections were the Jeffery Dewitt Insulator Company, Huntington, W. Va., in the capacity of electrical and later general manager and the Belden Manufacturing Company, Chicago, as chief engineer. In 1927 he was appointed assistant to the president, Underwriters Laboratories, Chicago, a position he held for eight years. Mr. Peaslee is a fellow of the A.I.E.E., and a member of the A.S.M.E. and of the American Association for the Advancement of Science.

Dr. Harvey N. Davis

president-elect of the American Society of Mechanical Engineers, has been president of the Stevens Institute of Technology since 1928. Nationally known as an educator in the engineering field, Dr. Davis is a member of many professional societies and the author of various papers dealing with thermodynamics.

G. R. Conover Made President of Electrical League Group

George R. Conover, who was elected president of the International Association of Electrical Leagues at the meeting held recently in New York, has been managing director of the Elec-

trical Association of Philadelphia since 1928.

A native of Bordentown, N. J., Mr. Conover received his education at Rider College, Trenton, and at the Drexel Institute of Technology. He is a licensed electrical engineer. He was formerly associated with the Public Service Electric & Gas Company, Newark, N. J., in the capacity of power engineer.

Mr. Conover was the winner of the Grand National Award, Legion of Honor Contest, Electric Refrigeration Bureau. He holds membership on the National Adequate Wiring Committee. He is a past-president of the Electrical League of South Jersey and is a member of the Illuminating Engineering Society, Philadelphia Trade Executives Association, and the New Jersey Professional Engineering Society.

OBITUARY

William H. Meadowcroft

William H. Meadowcroft, who was an assistant and confidential secretary of the late Thomas A. Edison, died, of pneumonia, October 14 at his home in Boonton, N. J., in his eighty-fifth year. Mr. Meadowcroft spent fifty years of his life in the service of Mr. Edison, from his twenty-eighth to his seventy-eighth year. During the years he was connected with the Edison Electric Light Company he came into close association with many of the pioneers whose names are engraved in the history of electric lighting.

Born in Manchester, England, Mr. Meadowcroft came to the United States at the age of 22 and entered the employ of the law firm of Carter & Eaton as a law clerk. In 1881, after six years with that firm, he was admitted to the New York bar. That same year, however, S. B. Eaton, one of the law partners, was elected vice-president and general manager of the newly formed Edison Electric Light Company and Mr. Meadowcroft became Mr. Eaton's assistant. Starting in an ordinary employee capacity, Mr. Meadowcroft's relationship with the famous inventor grew with the years, and in 1910 he was made assistant and confidential secretary to Mr. Edison. From then on, until Edison's death in 1931, he devoted himself to Mr. Edison and his interests. He was a founder member of the Edison Pioneers and served as president in 1927.

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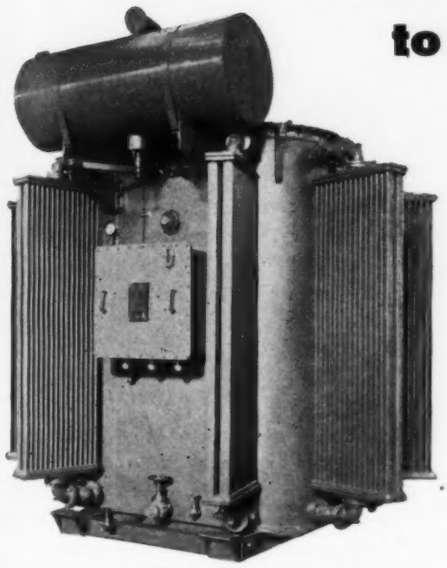
► WILLIAM H. CUSHMAN, hydro-electric engineer of Watertown, N. Y., and assistant district engineer of the WPA, was killed instantly in an automobile accident on October 10 near La Fargeville, N. Y. Mr. Cushman went to Watertown about 20 years ago and was engineer on the Black River project for the Northern New York Utilities, Inc., and for the same company at Oswego. He was engineer on the power canal project of the Aluminum Company of America at Massena, N. Y., and served as consulting engineer on Watertown's municipal power plant. He also supervised the construction of power projects in Costa Rica, Pennsylvania, Oregon and several southern states.

► SIR WILLIAM RAY, who played a prominent part in the electrical development of Great Britain, died recently in London at the age of 61. He was formerly member of Parliament for Richmond and for more than 20 years was a leading member of the London County Council. In 1933 the Council of the British Electrical Development Association unanimously appointed Sir William executive chairman. In this position he did much organizing work and directed the association's campaign to make Britain "electrically minded." In 1936 he was obliged to resign because of failing health.

SERVICE

AmerTran is flexible . . . is set up to build what you want quickly

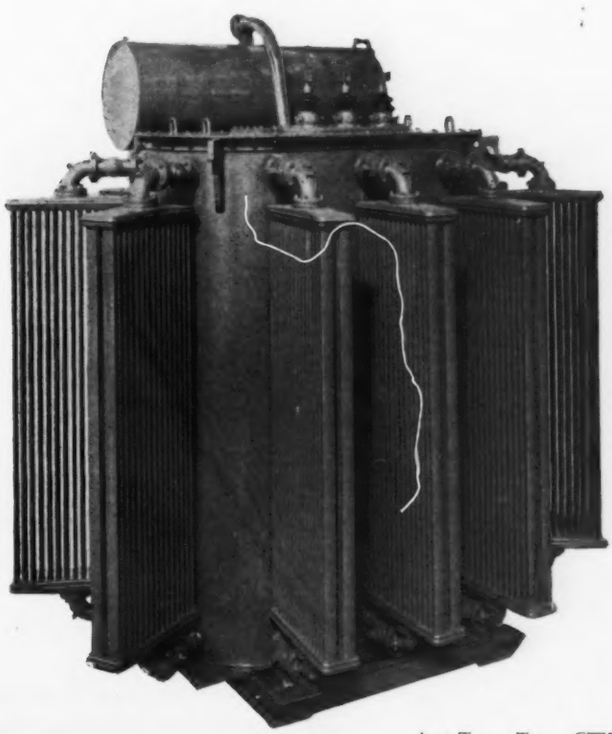


AmerTran Type CTV three-phase power transformer. Rear view showing high-voltage junction box.

Small enough for flexibility . . . large enough to do the job right. This describes American Transformer Company and explains why so many engineers prefer AmerTran Transformers. Our flexibility permits utmost speed in adapting latest refinements . . . in developing special apparatus . . . in manufacturing equipment following receipt of your order. Moreover, our background of 36 years' experience plus complete facilities for manufacturing all types of transformers insures that every job is made in accordance with highest standards. May we demonstrate the advantages of our product by submitting data on transformers for your needs?

Ask us about these
FEATURES

1. High turn-to-turn insulation.
2. Linear surge-voltage characteristic.
3. Fully balanced coil design.
4. Coils vacuum impregnated.
5. Rigid core construction.
6. Optimum impedance characteristic.
7. Tanks pressure tested.
8. Electrically brazed connections.
9. External parts rust resistant.



AmerTran Type CTV three-phase power transformer. Front view showing low-voltage bushings.

AMERICAN TRANSFORMER CO.
178 Emmet St., Newark, N. J.

AMERTRAN TRANSFORMERS

Manufactured Since 1901 at Newark, N. J.

Manufacturing AND MARKETS

Dyment Sees Increase in Canadian Business

Business of Canadian General Electric Company this year is expected to be substantially ahead of last year, according to A. E. Dyment, chairman of the board. Mr. Dyment indicated that while business is continuing to show a substantial gain over last year, it is not as great as it was during the first five months when bookings were fully 50 per cent ahead of the same 1936 period.

It is estimated by Mr. Dyment that for the full year business would be between 35 and 40 per cent ahead of 1936. So far this year business is running about 40 per cent ahead of a year ago.

The increase in volume in business is not expected to be fully reflected in earnings, Mr. Dyment said, because of rising costs. He also indicated that there is nothing in the general situation in the Dominion to suggest any change in the business trend for some time to come. While some concern over the drastic decline in American security prices and, in turn, on the Canadian markets has been indicated, Mr. Dyment finds that this situation is less attributable to business conditions than to a psychological condition caused by uncertainty over the future course of the Washington administration.

•

Electrical Machinery Fourth In Yearly Contracts Reports

Contracts for electrical machinery, numbering 272 and amounting to $18,608,571, represented 7.55 per cent of the $246,587,806 (4,575 contracts) reported by 27 agencies of the U. S. Government as awarded to contractors in the U. S. and territories, under the Walsh-Healey Public Contracts Act, in the year ended September 28, 1937.

The report, as announced by the Department of Labor, places electrical machinery fourth, from the standpoint of value represented, in the industrial classification of contracts.

•

Westinghouse Awarded Contract for Stations

A contract amounting to $700,000 has been awarded the Westinghouse Electric & Manufacturing Company for 44 radio range stations of the improved simultaneous type which permit continuous transmission of "on course" signals without interruption for weather broadcasts.

The new radio range stations, which transmit signals marking the lanes of the national airways, have been ordered by the Department of Commerce. Range stations built by Westinghouse will be located at points in the national airways extending from Camden, N. J., to Bakersfield, Calif., and from Tampa, Fla., to Tacoma, Wash.

Starting next March, installation of the new stations will be made at the rate of six each month until the 44 ordered have been placed in service.

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Square D Issue Limited

The maximum number of shares f $1-par common stock to be issued by the Square D Company under the registration statement filed with the SEC will not exceed 25,000, F. W. Magin, president, has announced.

•

Joins Standards Group

Among the new industrial groups which have joined the American Standards Association since last March, is the American Society of Refrigerating Engineers.

General Electric Net Shows Increase of 50%

Profits of General Electric Company for the first nine months this year showed an increase of 50 per cent over the same period last year and sales billed showed a gain of 38 per cent. Gerard Swope, president, stated that sales billed during the first nine months totaled $260,773,533, as against $189,263,156 in the same 1936 period.

Profits available for dividends for the first nine months were $39,663,931, equivalent to $1.38 a common share, as against profits of $26,533,667, or 92 cents a common share, in the first nine months last year.

Mr. Swope stated that dividends of 40 cents a share were paid during the first two quarters and that an additional 40 cents will be paid on October 25 for the third quarter. Last year 75 cents a share was paid during the first three quarters. Comparative statement follows:

	Nine months ended Sept. 30 1937	1936
Net sales billed...	$260,773,533	$189,263,156
Costs, expenses, all charges except interest	228,813,934	169,804,196
Net inc. from sales	31,959,599	19,458,960
Other inc., less int.	7,704,332	7,074,707
Profit avail. for div. on com. stock..	39,663,931	26,533,667
Net per share....	$1.38	$0.92

Mr. Swope pointed out that orders received during the first nine months totaled $305,276,566, as against $211,891,038 in the same 1936 period. On September 24 there were 197,104 stockholders, as against 188,985 a year ago, an increase of 4.3 per cent.

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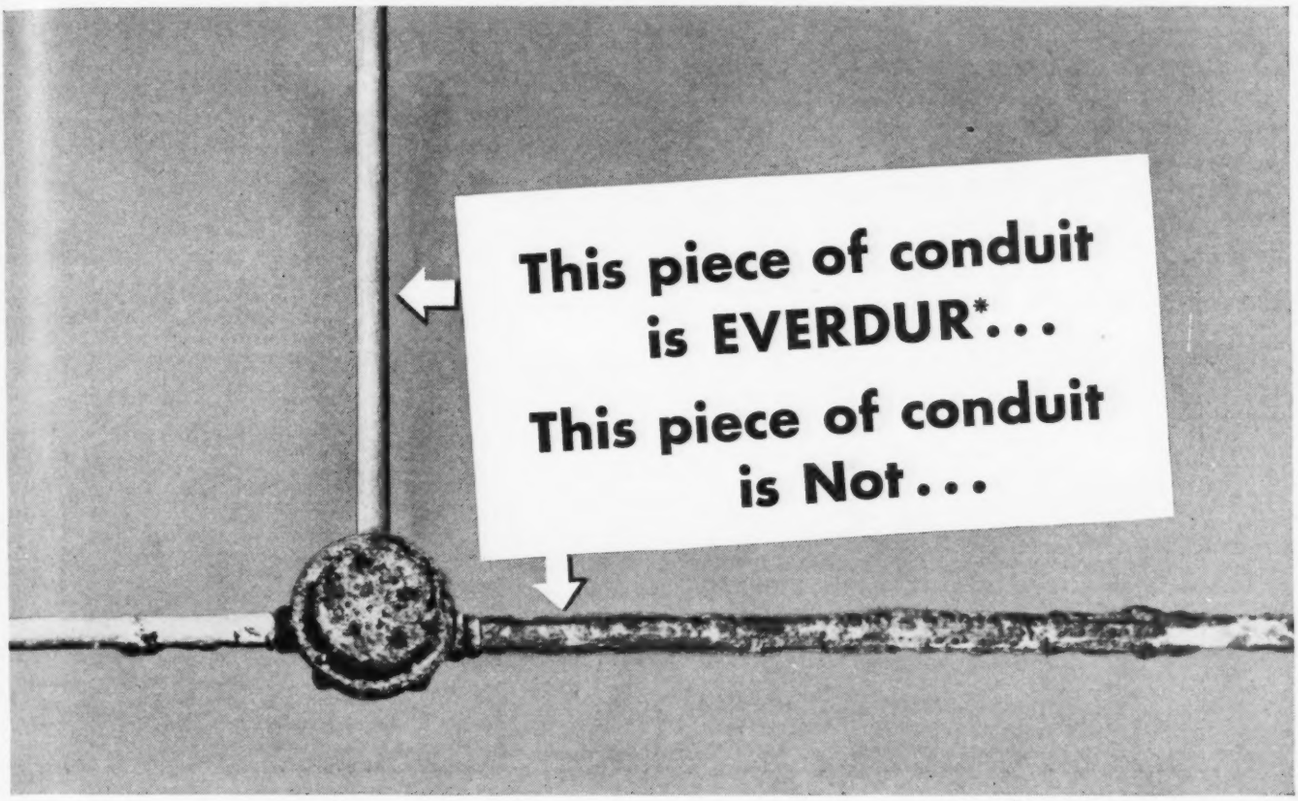
Johns-Manville Wages Up

Employees of the Johns-Manville Corporation plant at Manville, N. J., have received a 10 per cent increase



Both were used under identical conditions in a meat packing plant for 2½ years

To complete the story: When the oxide coating was wiped from the trial length of the Everdur Conduit no serious corrosion or deterioration had taken place. The conduit would be good for many more years of service.

The rustable metal conduit was badly corroded by the acid atmosphere and was crumbling away at the couplings and junction box. Two and one-half years was its useful life in the hair room of a meat packing plant.

Everdur Electrical Conduit, made from The American Brass Company's Copper-Silicon Alloy, is strong, durable, and highly resistant to a wide range of corroding agents. It is ideal for installations exposed to corrosive conditions or hazardous locations, and where freedom from costly repairs and maximum safety are primary considerations.

Of uniform temper and size, Everdur Conduit can be cut, threaded, bent and assembled with the same equipment used for steel conduit or tubing. It is manufactured in standard sizes and in two wall thicknesses; electrical metallic tubing (E.M.T.) and rigid conduit (R.C.).

Everdur Electrical Conduit is listed and labeled by Underwriters' Laboratories. Several complete lines of threaded and threadless Everdur Fittings are available. Write for Anaconda Publication E-12 37307

ANACONDA from mine to consumer

Everdur Metal

RUSTLESS AS COPPER
STRONG AS STEEL

THE AMERICAN BRASS COMPANY, Buffalo Branch: 70 Sayre St., Buffalo, N. Y.
Offices and Agencies in Principal Cities • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

*EVERDUR is a trade-mark of The American Brass Company, registered in the United States Patent Office.

in wages, following recognition of the Johns-Manville Employees Association, an independent union, as the sole bargaining agent of all employees at the plant. Included in the agreement signed with the union are provisions for an eight-hour day and a 40-hour week.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have announced the following sales appointments:

Roller-Smith Company has appointed C. F. Cate of El Paso, Tex., as its agent for the southwestern portion of Texas and the southern portion of New Mexico.

Cutler-Hammer, Inc., has appointed Elmer F. Weiss as manager of the Detroit office. Mr. Weiss succeeds A. R. Johnson, who has recently assumed new duties. Mr. Weiss' wide experience in all phases of motor control applications makes him well qualified for his new position.

Opening of Kelvinator's new sixth household appliance sales region, headed by J. F. Crossin, formerly eastern regional manager, has been announced by Ralph C. Cameron, sales manager household appliances, Kelvinator division, Nash-Kelvinator Corporation. The new region will have its headquarters in Detroit, and will cover western Pennsylvania, West Virginia, Ohio, parts of Kentucky and Indiana and the lower peninsula of Michigan. Keith L. Saunders has been appointed eastern regional manager to succeed Mr. Crossin.

•

Superheater Net $2,167,734

Superheater Company, excluding its Canadian affiliate, reports net income for the nine months to September 30 of $2,167,734, including $425,115 nonoperating profit on sales of reacquired company stock. Net income in the same period of 1936 was $674,025.

•

New Export Offices Opened

Rounding out their program of expansion, Samson-United Corporation has announced the opening of new export offices at 377-79 Broadway, New York City, with Joseph Plasencia as export manager.

New York Metal Prices

	Oct. 13, 1937 Cents per Pound	Oct. 19, 1937 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead Am. S. & R. price	6.00	5.50
Antimony	16.50	16.50
Nickel ingot	35.00	35.00
Zinc spot	6.60	6.35
Tin Straits	54.00	50.25
Aluminum, 99 per cent	20.00	20.00

* Delivered Connecticut Valley.

Field Reports on Business

In the face of the drastic drop in security prices, business is holding up well. Electrical manufacturers report a fair volume of new orders. The decline in industrial activity is expected to be reversed with new buying when stocked shelves are emptied.

NEW YORK

Industrial leaders are viewing, with some apprehension, the drastic decline in security prices as to its effect on business this fall and next spring. Many are of the opinion that the slowing down in industrial production is not an indication that another depression is in the making. It is well known that a great deal of forward buying took place last spring when prices were soaring and labor disturbances were widespread. The belief exists that much of this forward buying and stocking of shelves accounts for the drop in industrial activity, and that business will pick up with new buying.

The drastic decline in security prices has tremendously upset confidence, and the dumping of securities of all types, even those held in strong boxes, has made for an acute situation. The announcement by President Roosevelt that the budget deficit has been raised to $695,000,000 and that tax collections have been much smaller than anticipated have added to the gloomy picture. The special session of Congress is held to be no road to restoring confidence in the situation.

A bright spot this week was the report of earnings of General Electric, which showed a net profit for the first nine months this year, 50 per cent ahead of the 1936 period. Profit was $39,663,931, against $26,533,667. Sales billed showed a gain of 38 per cent, $260,773,533, against $189,263,156.

Electrical manufacturers report a good volume of business and that production is being maintained at a high rate. Utilities report that construction programs are progressing at an encouraging rate. Power production is holding up well, with residential consumption tending upward with colder weather.

PACIFIC COAST

Large contracts and awards, both for construction and machinery, predominate in current Coast business, with considerable new public construction announced. The low bidder's figure was $484,507 for the trolley catenary and feeder system for the San Francisco Bay Bridge Interurban Railroad, to be in operation in November, 1938. Low figure for two butterfly valves, size 168 in., for Boulder Dam power house was $325,000, and bids are being requested for two each 23,000-volt bus structures and 138,000-volt disconnect switches. Other power apparatus sales include $75,600 for a 900-hp. Diesel engine plant for Alturas, $45,000 covering transformers, towers, switchyard and switching equipment for Pioche, $30,376 for three pumping units for Owyhee project in Idaho and $95,000 for feeder voltage regulators for the Los Angeles system.

Railroad business reflects heavy traffic, both freight and passenger, and includes $500,000 addition to Western Pacific shops in Sacramento, a $250,000 warehouse for Northern Pacific in Seattle, the $500,000 Santa Fe terminal in San Francisco, now nearing completion, heavy orders for signaling wire and cable by Southern Pacific and an announced expenditure of over $5,000,000 by Western Pacific within the next five years mainly for trackage, but necessarily including some electrical circuit work for signaling and communication.

Electrical wholesalers report good, steady business, though on a midyear basis without the predicted fall pickup. Dealers' holiday stocks of appliances reveal an expectation of about 10 per cent over last season. Coast stocks in all lines average a third increase over January inventories, partially justified by increased business.

NEW ENGLAND

Industrial electrical equipment orders were received in good volume during the past week; small motor buying is active, with machine manufacturers placing frequent orders. One representative notes that his sales during the past week included two groups of 15-hp. motors for a central Massachusetts machine manufacturer, more than 200 ¼-hp. motors to a western Massachusetts manufacturer and an encouraging number of single orders running from 1 to 10 hp. Small switch and control sales are running along at a good pace.

Utility buying is spotty; bids are in for considerable electrical accessory equipment for the Boston Edison Company. A New England representative recently received orders for 20 Richardson automatic coal-weighing scales from New York and Middle West utilities.

Arc welder units are in good demand and sales are progressing. Recently a manufacturer of high-speed colloidal machines operated by 5-hp. motors placed orders amounting to about $2,000. An order has been passed by the Boston City Council authorizing additional street lights for the Jamaica Plain district at a cost of $3,000.

Preholiday merchandising in the Boston area is beginning to gather momentum; one representative notes a strong demand in electric laundering appliances; in Vermont sales of major appliances are reaching a high level in volume.

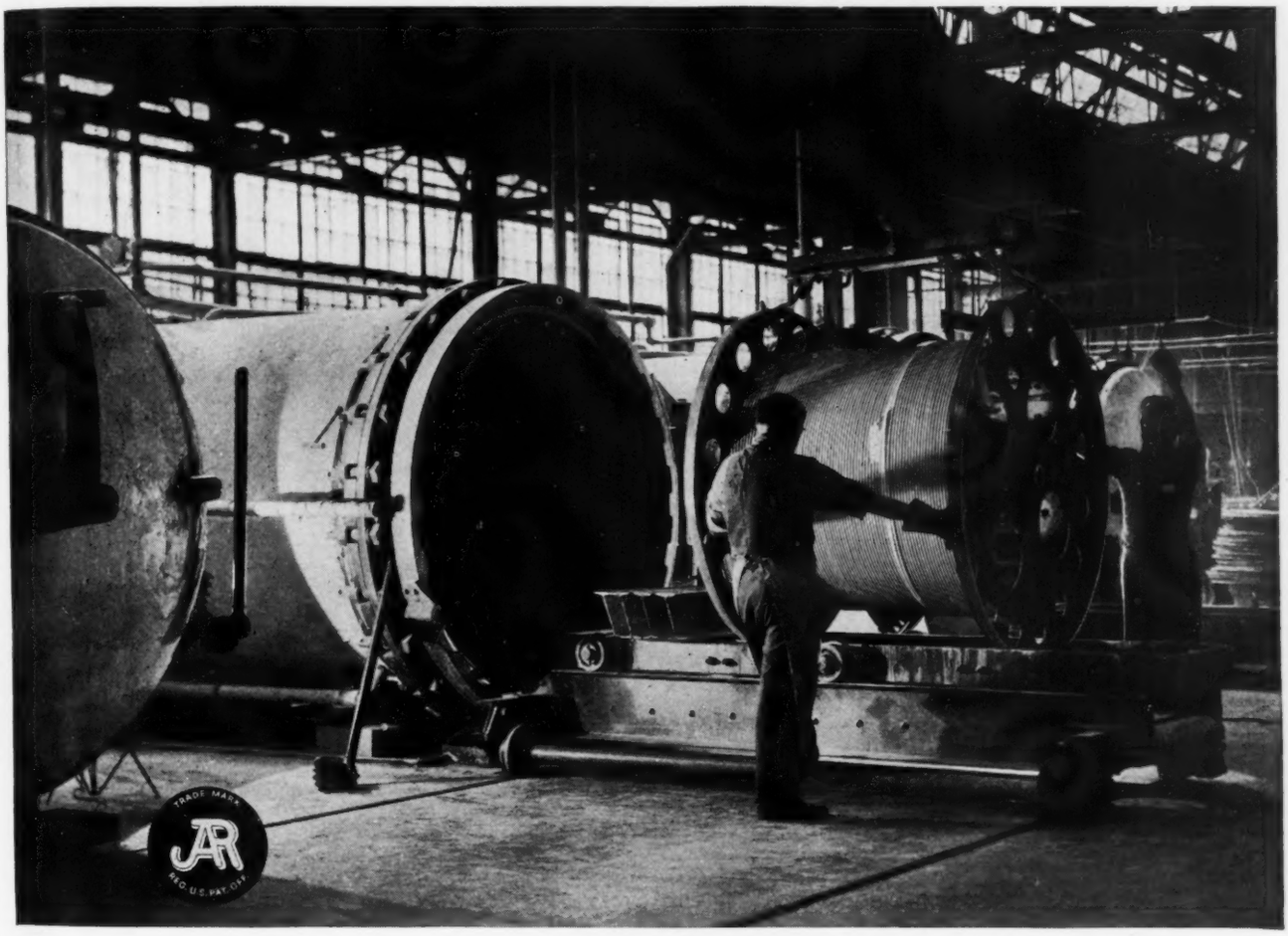
CHICAGO

Further recessions occurred in many lines during the past week. Activity in some heavy industries was reduced to a level below that of 1936, giving evidence of hand-to-mouth buying in certain lines. Production of the steel mills in this area dropped 8 points to 57 per cent of capacity, causing several of the mills to cut employment to three days a week. However, some sizable orders for electrical equipment are coming from the mills as a large amount of construction work previously started is still in progress.

Retail trade is holding up exceptionally well, evidence that purchasing power, by and large, has not been materially reduced. Appliance sales are well above last year's levels and wholesale activity has shown moderate increases over the last few weeks.

A prominent manufacturer of central station equipment reports no reduction so far in orders, but that inquiries have fallen off, indicating that a decline is imminent. Another well-known maker of wire and cable products reports sales 50 per cent above last year and entered the last quarter with a backlog twice that of a year earlier.

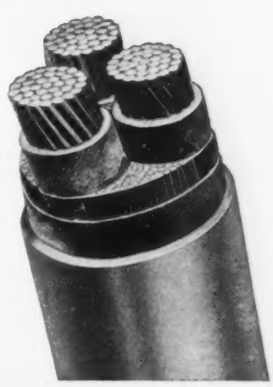
Proper Vulcanization
OF RUBBER INSULATED POWER CABLE
is a "fine art" at Roebling



HERE is an open vulcanizer ready to receive a reel of rubber covered wire for power cable. Under automatically controlled heat for a predetermined time, the rubber will come out properly vulcanized—to meet required electrical and physical qualities.

This is but one of the many processes of manufacture where close control and long experience guard the high quality of Roebling Rubber Insulated Power Cables.

These cables are available in a wide range of sizes and voltages and grades of insulation for power transmission, lighting and signal service—underground submarine or aerial.



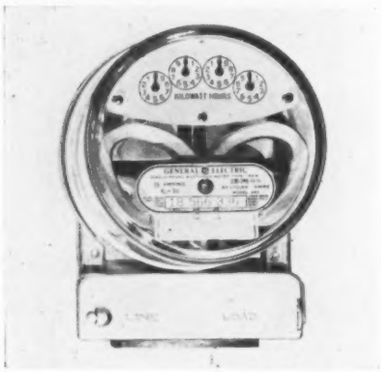
JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

New EQUIPMENT AVAILABLE

Wide-Limit Watthour Meter

Designed primarily for residential loads, this single-phase meter with a nameplate rating of 15 amp. is said to have a practically flat accuracy characteristic from 0.5 to 60 amp. Two features of the meter are new driving element with compensating shunt for high and low current values and new light load and lag adjustment compensated for effect of temperature variations when loads of less than unity power factor are being registered. It is said that only very small amounts of compensation are required to produce the straight-line characteristics.

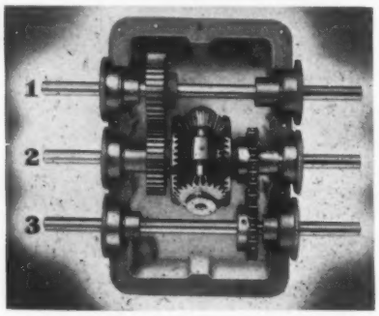


Type I-30; 120 or 240 volts, two- or three-wire service; bottom connection or socket or plug-in mounting. **General Electric Co.,** Schenectady.

•

Automatic Speed Control

Developed for use with the company's variable speed transmission, for a variety of speed control requirements, this unit is similar in principle to an automobile differential. Shafts 1 and 3 are connected to the driven machine or machines, shaft 2 to the speed changing screw of the transmission. Shaft 2 stands still so long as shaft 1 and 3 travel at the same speed in the same direction. When the speed of the driven machine varies above or below the desired speed, this variation is transmitted to shaft 2 which speeds up or slows down the transmission until synchronous speed is regained.



Model MDB-3; said to permit infinite range of speed variation; may also be used as primary driving equipment. **Reeves Pulley Co.,** Columbus, Ind.

•

Main Service Switch

In this new service switch, the main fuses have been replaced by a switch employing silver-to-silver contacts and operated from outside the case, like the familiar toggle switch. Test holes are provided in both range and branch circuit fuse blocks to permit testing of fuses without service interruptions. Both case cover and door over branch circuit fuses are provided with slots to accommodate any type of meter sealing. Switch blades are separate from fuse clips to reduce contact temperature.

Bulletin 4334 H17; 60-amp.; approved by 1937 National Electrical Code. **Cutler-Hammer, Inc.,** Milwaukee.

•

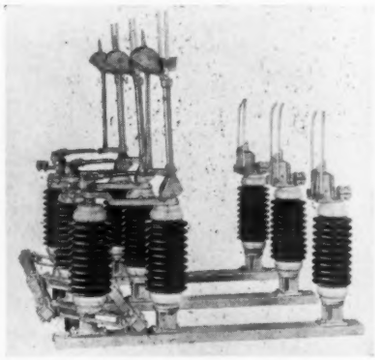
Vertical Centrifugal Pump

Figure 6640 ejector centrifugal pump for deep wells; with pressure tank and automatic controls. **Fairbanks, Morse & Co.,** Chicago.

A vertical, close-coupled, motor-driven centrifugal pump for general service in deep or shallow wells is a recent announcement of this company. It is suggested for pumping water under either high or low pressure at 6 to 60 g.p.m. For deep well service, the pumps are equipped with an ejector and venturi in one of the two drop pipes extending from the pump down into the well, the ejector being added to lift water from depths beyond that from which the centrifugal pump alone will lift it.

Vertical Break Switch

Trouble-free service in all weather at low maintenance cost is said to be assured by this new rotating insulator, vertical break switch. Switch blades slide into the completely housed contacts from beneath after switch arms have completed their downward swing and are in position for contacting; arcing horns protect the contacts. Tubing construction and rounded corners are employed to keep corona discharge down, spring contacts between operating links and all contact parts are used to prevent vibration and radio interference.

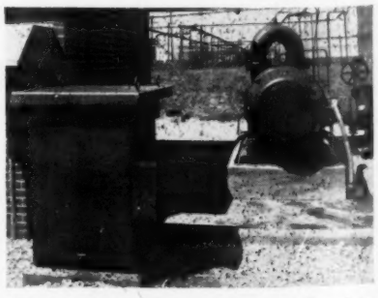


Ratings: 7.5 to 69 kv., 400, 600 and 1,200 amp. **Line Material Co.,** South Milwaukee, Wis.

•

Explosion-Proof Linestarters

Developed primarily for petroleum and chemical industries and other hazardous applications, new high-voltage linestarters are completely oil-immersed and corrosion-resisting with high interrupting capacity and intended for starting squirrel-cage and wound-rotor induction motors. Internal assembly for both floor- and frame-mounted starters consists essentially of main switch



Type "LNO;" max. ratings 700 hp. for 2,200 volts, 1,250 hp. for 4,600 volts, 25, 40, 50 or 60 cycles, three poles. **Westinghouse Electric & Mfg. Co.,** East Pittsburgh.

with operating mechanism and auxiliaries, operating transformer, current transformers and overload relays. Starter is operated by special two-button oil-immersed push button station.

•

Tensile Strength Tester

Companies engaged in testing insulation materials may be interested in this testing instrument, designed for determining simultaneously tensile strength and elongation

"Amthor" universal tensile strength tester; three pulling speeds provided by 1/6 hp. constant speed motor; maximum capacity, 300 lb. **Amthor Testing Instrument Co., Inc.,** Brooklyn, N. Y.

of wire, cordage, rubber, paper and other flat materials. Load is indicated by a capacity lever on the quadrant which has a triple-range scale; readings remain fixed after the specimen breaks. Elongation dial indicator is graduated in 0.05 in. subdivisions and in per cent. Clamping distances are adjustable with automatic limit stops; pulling clamp has maximum travel of 24 in. and returns to starting position after each test.

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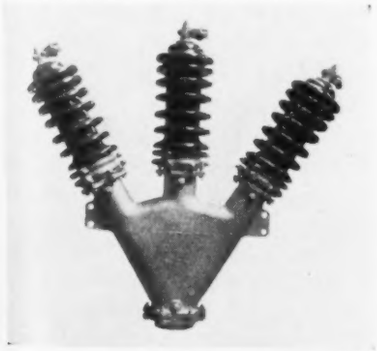
Outdoor Cable Terminator

Body of this three conductor terminator is of high strength aluminum alloy, designed so that the amount of filling compound is a minimum, giving low shrinkage effect. Sep-

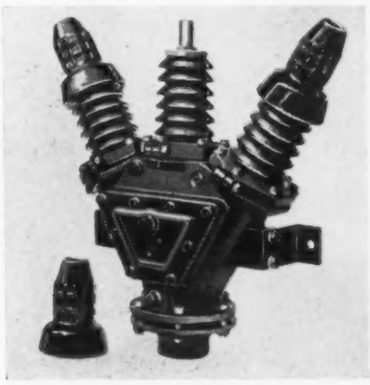


Rated at 34.5 kv., used on 27 kv., 500 amp. cable; 18 in. striking distance between phases at bushings; oil or compound filled. **Delta-Star Electric Co.,** Chicago.

arately mounted wet process porcelain bushings permit field replacements without disturbing other bushings. Cemented joints are absent and no current is carried through the threaded joints, it is claimed. Inverted type wiping sleeve entrance permits use of wiped cable joint with terminator mounted on conduit.

Cable Disconnect Head

Convenient means for disconnecting leads from cable end bells is offered in this new disconnecting head for use with the "Three E" capnut style of bell. Head housings are made of wet process porcelain; internal parts are copper. Lower contacts are in the



Heads are available for conductors to 500 m.c.m. and 15 kv. **Electrical Engineers Equipment Co.,** Melrose Park, Ill.

form of sleeves, with non-corrosive contact springs, that slip over studs of capnut terminals when heads are placed. Dummy studs and caps are also available so conductor and bell terminals may be insulated and protected during periods of disconnection.

•

Controller Drum

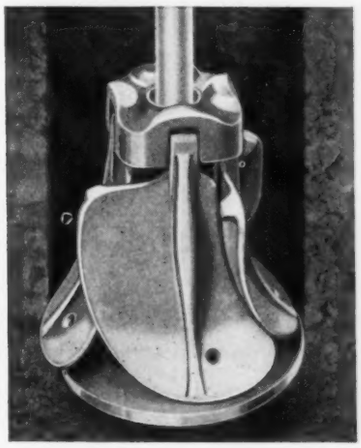
Fourteen-notch controller drum. **General Electric Co.,** Schenectady.

A new fourteen-notch controller drum has been developed to give faster and smoother acceleration of cars that have been modernized with field-shunting equipment and rewound motors for higher speed operation. Drum can be installed in company's "K-35" and similar controllers with only a few changes in stationary contact elements, it is said. It has 23 segments, twelve of which are duplicates.

•

Expansion Anchors

Three new sizes of four-way type high tension expansion anchors have been recently added to this company's line of two-way, three-way and four-way types. Special contour of blades is said to provide minimum earth disturbance during installation and high



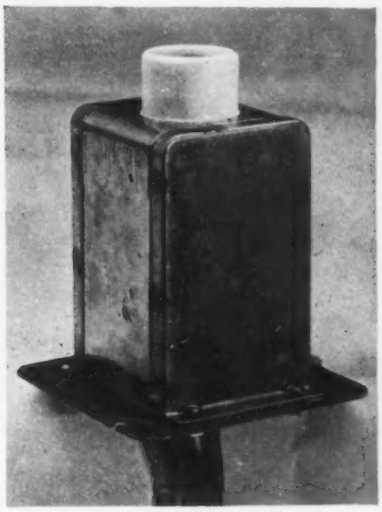
Maximum holding power, 21,000 lb.; line ranges in size from 3¾ through 10 in. **James R. Kearney Corp.,** St. Louis.

ratio of blade area in undisturbed earth after blades are expanded. Recessed socket on disc serves as nut retainer and allows easy salvaging of anchor rod besides preventing rod from sliding through disc. Blades and disc castings are ribbed for mechanical strength.

•

Loom Transformers

Warp-stop loom transformers, designed to meet requirements of the textile industry, are available in special or standard units.



Warp-stop loom transformers; rated at 25 volt-amp.; secondaries, 12 volts; primaries, 115, 230, 460 or 575 volts. **Westinghouse Electric & Mfg. Co.,** East Pittsburgh.

Special units are totally inclosed and compound-filled, have fuse protection in series with the secondary to protect the transformer. Standard units are of conventional air-cooled transformer design with end cases to protect ends of coils.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

N.E.M.A. Publications—Two recent publications of the National Electrical Manufacturers Association, 155 East 44th Street, New York, are "Industrial Control Standards," Publication No. 37-44, and "Instructions for Care and Operation of Transformers," Publication No. 37-46. Industrial control equipment is covered by the first pamphlet, priced at 60 cents, and both distribution and power transformers by the second, priced at 25 cents. Copies are available from the association headquarters.

The M-R Wall Sheet—Included among the useful engineering data tabulated or listed on this wall chart are: Table of tap drill sizes; electrical symbols for architectural plans; copper wire card; table of allowable carrying capacities of conductors; breakdown voltages for various common insulating materials; varnished tubing sizes; temperature conversion tables; decimal and metrical equivalents of fraction of an inch. Mitchell-Rand Insulation Company, 51 Murray Street, New York, will send the chart on receipt of 15 cents.

starts with today's PLANNING

The Electric Utility Industry in ten years has

Gained . . . 6,000,000 more Customers
Electrified . . 800,000 more Farms
Invested . . $5,000,000,000 more in its Plant
Added . . . 11,000,000 Kw. to its Capacity

and this was accomplished during the last ten years — a period including the worst depression this country has ever known.*

Now . . . 1937 Industrial Production is still 11% below 1929, but Electric Utility Output is 13% above 1929. That's why construction budgets for transmission and distribution are being pushed up again. That's why utilities are busy planning for new capacity. Regardless of when the actual orders are placed, remember that tomorrow's buying action starts with today's planning.

* From talk by C. W. Kellogg, President Edison Electrical Institute before the Pennsylvania Electric Association, Bedford Springs, Pa., September 10th, 1937.

To sell the electrical industry (Light and power companies, electrical manufacturers, industrial electrical engineers), concentrate your advertising in the industry's FIRST paper—

ELECTRICAL WORLD

Electrical World shows up First consistently, year after year, as the preferred publication among readers. They ought to know! It has the greatest A.B.C. paid circulation . . . 15,626 net paid, June, 1937. It carries three times the advertising of the nearest comparable publication.

A McGraw-Hill Publication

330 W. 42nd St.
New York, N. Y.

Hartford Mercury Unit's Record Under 11,000 B.t.u.

[*Continued from page 55*]

tain other betterments which cut the year's output to a little under 13,000,000 kw.-hr. From that time on, however, the unit has been "on the job" between 6,500 and 7,600 hours annually, giving an excellent availability ratio in proportion to the 8,760 hours comprised in the normal year. A summary of the more essential performance data for the period is presented in Table I.

Table II gives the month-by-month performance of the mercury unit in this plant for the first half of 1937. Here the range of B.t.u. economy has been from 10,050 to 12,258 per kilowatt-hour, a high efficiency being realized whenever the monthly hours' run exceeded about 560. This extensive usage was the case with the exception of April, and even then a very good B.t.u. rate was realized as set against modern normal steam plant practice.

•

Five-Year Rural Contract

Under the terms of a contract which has been approved by state and federal authorities the Washington Water Power Company will supply electrical energy to the lines of the Inland Empire Rural Electrification, Inc., for a period of five years. Contract became effective October 1. Plans for a $90,000 Diesel plant, which was to have been erected at Rosalia, Wash., have been abandoned in favor of the purchase of power from the utility company.

•

Demonstrates Appliances

One of the outstanding features of the Canadian Pacific Exhibition in Vancouver, B. C., was the large displays of the B. C. Electric Railway Company demonstrating the use of electrical appliances in the home and on the farm. Electric soil heating, farm lighting and machinery and household appliances were demonstrated.

•

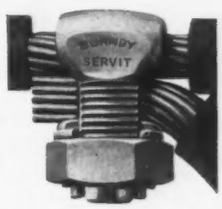
New Borg-Warner Building

Construction of a $500,000 building for the mechanics universal joint division of the Borg-Warner Corporation has been begun at Rockford, Ill.

THE sturdy little burro offers an object lesson in stamina. Though light in weight and diminutive in stature, he bears the brunt of heavy loads... mile after mile.

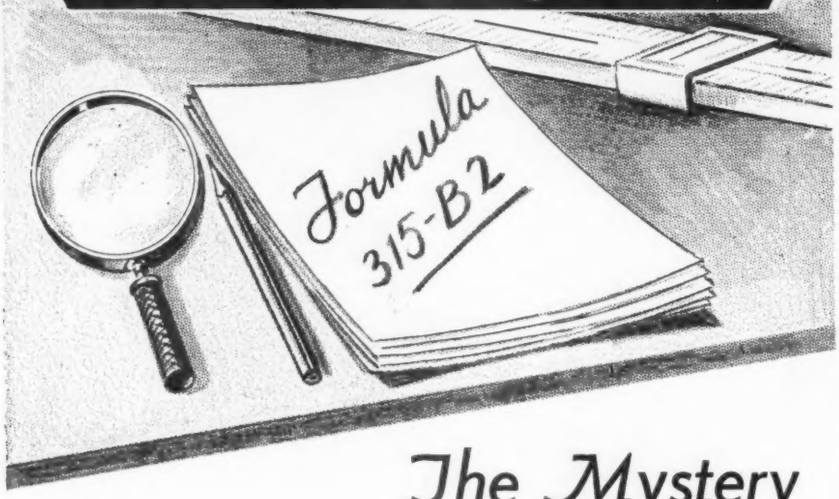
In service connectors, too, lightness, compactness, toughness are vital characteristics. Evermounting power loads demand high electrical efficiency; excessive wrench pressures call for extra strength; "line-sag," due to heavy, bulky connectors, must be avoided; tight-corner jobs, beyond the reach of solder and blow torch, demand the convenience of a compact connector.

In the Burndy Servit (illustrated) connector users the world over have found those qualities which make for dependable service and true economy. Specify Servits . . . confidently! Burndy Engineering Co., Inc., 459 E. 133d Street, New York, N. Y.



BURNDY
CONNECTORS

INSULATION HEADQUARTERS



The Mystery
SOLVED!

It was the difficult case of an extremely thin gauge laminated insulation where dielectric strength had to be greater than normal without sacrificing physical strength. Insulation headquarters was brought into the picture and Continental-Diamond's engineers went to work. It took a thorough knowledge of *all* insulating materials and many experiments to solve the problem involved. But the solution was found and thereby another satisfied customer obtained. In our hundreds of formulae we may have exactly the right one to produce an insulation that will improve your product's performance or reduce production costs. If we haven't, we know it can be developed here. Write, telling us how we can serve you best.

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DILECTO
A laminated plastic, commonly known as phenol fibre, made in sheets, rods and tubes or fabricated parts to specifications. Has high electrical insulation properties, great resistance to water, practically unaffected by oil or mild acids. It is a strong, tough material with a wide application for use in connection with modern electrical appliances.

DIAMOND VULCANIZED FIBRE
A tough, economical, insulating material made in standard sheets, rods and tubes. Can be readily fabricated or formed. A material of countless applications.

VULCOID
A thermo-plastic, non-hygroscopic insulating material made in standard sheets, rods and tubes. It is strong and tough, has good electrical insulating properties and is readily fabricated.

MICABOND
Thin splittings of mica bonded together with specially developed binders into standard plates, tubing or in formed rings, punched and sawed segments or other special parts. Micabond has high dielectric strength, is practically unaffected by acids, has high heat and moisture resistance, is readily punched, sawed or formed.

CELLULAK
A laminated form of insulating tubing, possessing extremely high dielectric properties, and marked resistance to flash-over.

DILOPHANE
A translucent, laminated plastic in colors. It provides perfect light diffusion, is not inflammable, and is manufactured in practically any color imaginable with either a glossy or dull finish.

Slide Rule Yields Lamp Flicker Data

[*Continued from page 54*]

in the non-cyclic range one should modify the thresholds by using higher values if the voltage change is gradual, and lower values when the voltage change is sudden.

Another point of interest is that in Fig. 1 the range of flicker period has arbitrarily been divided into four bands with descriptive titles and frequency limits. Representative items of utiliization equipment which may cause lamp flicker have been listed in the appropriate bands. The purpose here was to extend the usefulness of the curves, so that if the flicker frequency in a particular case were not definitely known, the curves might be entered according to the equipment producing the flicker and the permissible voltage variation thus determined. As a matter of general interest, the range of maximum eye sensitivity to cyclic flicker, namely, 10 to 5 cycles per second, has also been indicated.

While the curves or thresholds previously described contribute a continuous summarizing relation between lamp flicker frequency and voltage variation, it was felt that some form of pocket-sized calculator or "slide rule" showing the general relation of the major variables in lamp flicker would prove useful to distribution design people and others. Accordingly a slide rule was devised whose construction and operation may be seen from Fig. 2. The device consists of a card free to slide, within limits, inside a transparent envelope to which are rigidly fastened, in turn, two sets of channels in which two vertical transparent sliders are free to move up and down. On the face of the card two threshold curves are drawn, using the summarizing threshold curves shown on Fig. 1. The two adjustable vertical sliders are laid out as voltage scales and when in position in their channels serve as ordinate scales for the threshold curves. On the reverse side of the card the arbitrary frequency bands and descriptive titles are indicated, and in them the groups of utilization equipment have been included. The card is assembled into the envelope by means of a rivet passing through the long slot in the card. This rivet and slot form a type of interlock, because of which the left-hand vertical slider can only be used

over a limited portion of the left-hand end of the card (the "cyclic range"), and the right-hand slider can only be used over the central and right-hand end of the card.

Operation of slide rule

An example of how the slide rule may be used is shown in Fig. 2. If it is desired to know what equipment is likely to produce cyclic flicker, what frequencies would be produced and at what magnitude of voltage variation complaints would probably be registered, say, by a customer using small-sized lamps the slide rule would be operated as shown.

The slide rule is offered as a device yielding lamp flicker information in a practical, convenient and flexible form. It is not, in any sense, a suggested set of standards for good system design. Standards of allowable voltage variation for system design will be found to lie between the thresholds or limits at points fixed by good judgment and individual system experience. The slide rule is proving to be of assistance in the analysis of flicker problems and the classification of flicker complaints.

•

Gets Twenty-Year Franchise

City Council of Youngstown, Ohio, has accepted by unanimous vote a rate agreement offered by the Ohio Edison Company and granted the utility a twenty-year light and power franchise. Under the new rate electric consumers in the city are placed on a par with those in Akron and, utility officials say, will save $475,000 annually. Most of the saving will accrue to domestic consumers. The company's franchise would have expired in 1942.

•

New Bendix Washer Displayed

Heralded as a revolutionary development in home laundry equipment, the new Bendix washer was shown to a national group of 75 distributors at the first convention of Bendix Home Appliances, Inc., at South Bend recently. Evidence of the washer's safety from electrical fire hazard was presented from the Underwriters' Laboratories, of its soap economy from Lever Brothers, soap manufacturers, and of its operability from *Good Housekeeping* magazine.

"MEGGER"

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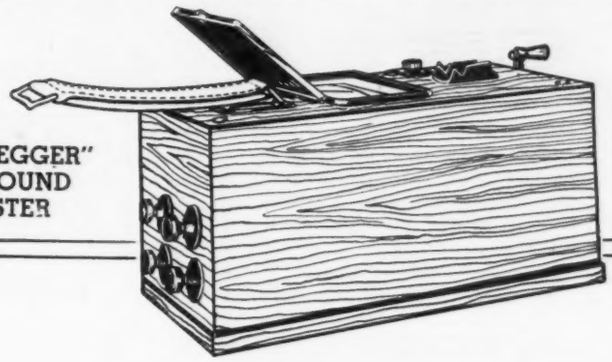

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. . . to protect equipment

. . . to insure continuity of service

"MEGGER" AND "MEG" GROUND TESTERS have brought to problems of grounding and ground testing the same features of simplicity, ruggedness and reliability that are so characteristic of our "Megger" and "Meg" instruments for testing insulation resistance.

They have made it easy and practicable to measure ground resistance and have been adopted by leading power companies, railroads, telephone and telegraph companies and large industrial plants throughout the United States.

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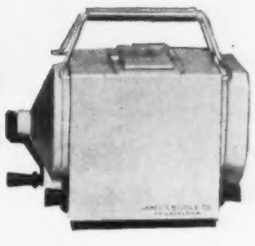

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All Pennsylvania Transformers have fundamental improvements which provide the maximum in service, economy and safety!

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All coils are circular, and so balanced that there is no tendency for radial or axial distortion under short circuits.

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Coils have low temperature gradient between copper and oil, a feature which permits heavy overloads with safety.

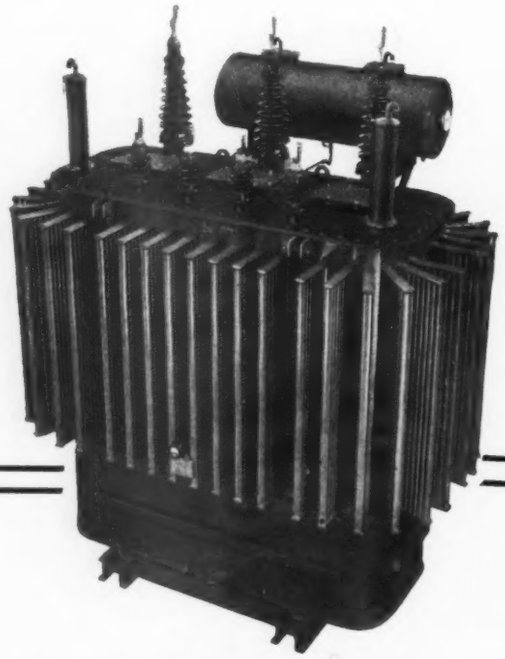
Freedom From Radiator Trouble

Pennsylvania Uni-Row Radiators, of 13-gauge steel, tested at factory for 100-pounds pressure, are built as an integral part of tank. They are permanently welded in position, eliminating flanges, gaskets and bolted connections. Each radiator consists of single row of tubes, which can be sand-blasted, cleaned and painted in factory or field.

Straight-in-line Tap Changing

Tap-changers are operated straight in line by rack and gear, with sliding low-resistance contact, eliminating backlash.

PENNSYLVANIA TRANSFORMERS



4500 kva
66 kv
3-phase

PENNSYLVANIA TRANSFORMER CO.
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Fitting Control Equipment to Conveyor Machinery

[*Continued from page 57*]

ance starters. Where remote starting is necessary, direct-current, magnetic starters may be used which introduce one or more steps of starting resistance into the motor circuit. This resistance is automatically cut out of the circuit as the motor comes up to speed. The time at which each resistance step is cut out is regulated by a timing mechanism or by counter-electromotiveforce operation on the cutting-out magnets. When such starters are employed their operation is effected by push-button actuation in a manner similar to that in alternating-current starting by across-the-line starters.

Across-the-line starters are so designed that any desired number of start and stop buttons may be used for the operation of a single starter. In connection with continuously operated conveyors a single starting button is usually sufficient, as the motor, once started, continues in operation until intentionally stopped. It may, however, be convenient to use auxiliary starting buttons in some cases so that the motor may be started at different points in relation to the conveyor. The use of stop buttons, on the other hand, is more general as it is desirable to place such buttons on all locations where anything might occur which would make immediate stopping of the motor necessary.

At the receiving end the operator should be able to stop the conveyor whenever a shortage of material makes a shut-down desirable, while at the delivery end it is frequently necessary to stop the conveyor to prevent piling up of material faster than it can be taken away. In connection with long conveyors especially a number of stop buttons should be installed along the length of the run so that emergency stopping may be promptly effected in case of accident, breakage of any part of the conveyor or an undue piling up of material along the line. In connecting additional buttons to the starter the start buttons must be connected in parallel and the stop buttons in series.

For the larger a.c. motors

For starting alternating-current motors of capacities too great to be thrown directly across the lines either the resistor or the auto-transformer type of starter is suitable, but the

latter, the compensator type, is more generally employed. The compensator is entirely satisfactory for use with squirrel-cage motors where the conveyor is started without load, or but lightly loaded, but it should be borne in mind that as starters of this type reduce the starting current applied o the motor they also reduce the starting torque of the motor in proportion to the square of the voltage that is applied. Standard compensators of 50 hp. and smaller are provided with taps so that either 80 or 65 per cent of the starting current may be applied to the motor, while those larger than 50 hp. have an additional tap providing for 50 per cent starting current (N.E.M.A. standard). The compensator may be connected so as to employ any of these available starting points, but, when used, the starting torque of the motor is reduced to about 65, 40 or 25 per cent of normal torque, respectively.

Drum type for wound-rotor

Magnetic starters of the auto-transformer type may also be employed for remote starting of squirrel-cage motors, but since the operation of the motors is continuous and starting comparatively infrequent the expense of such starters is not generally warranted. Standard manually operated compensators are equipped with a stop button in the inclosing cover and additional stop buttons may be installed at various vantage points, thus providing the remote stopping feature of the magnetic starter.

When the conveyor is to be started under full or heavily loaded conditions a wound-rotor motor is frequently employed and the starter is then usually of the drum type, by which resistance is successively cut out of the secondary circuit as the motor comes up to speed. Magnetic starters are also available for use with wound-rotor motors, but their comparatively high cost does not always warrant their employment.

For direct-current motors any of the standard types of either dial or drum starters may be satisfactorily used. In some cases direct-current motors that are to start under heavy load conditions are constructed with compound fields so that they may be started as compound-wound machines, but when running speed is attained a connection on the starter cuts out the series winding so that the motor operates as a shunt-wound machine.

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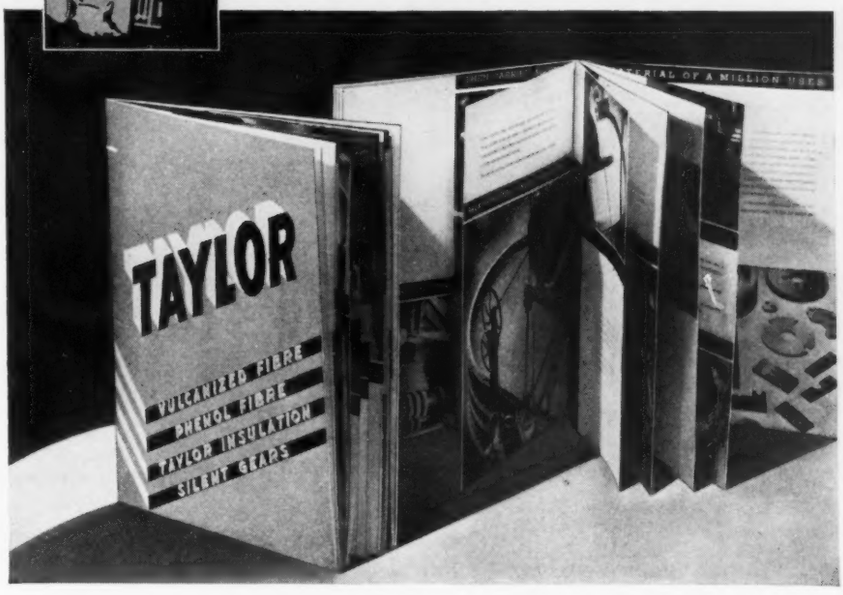

If you use fibre, you'll find our new book full of valuable information. It takes you through the Taylor Mill—most modern, up-to-the-minute Plant of its kind in the world... It shows you how Taylor Vulcanized Fibre, Taylor Insulation, Taylor Phenol Fibre and Silent Gears are made. It pictures and describes processes and equipment that give Taylor products their high uniform quality—the reason why they are preferred by executives and engineers in many industries.

Reading it, we believe, you too will be convinced that the superiority we claim for Taylor products, and the efficiency of the service we offer to our customers, are no idle boasts.

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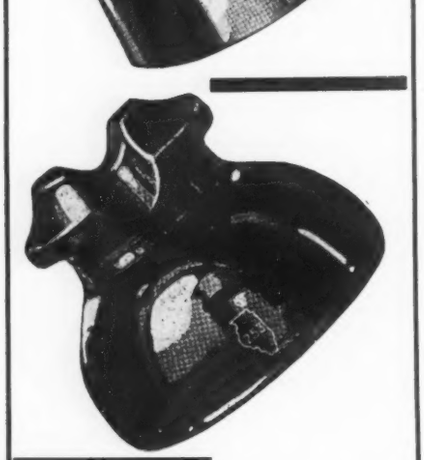

● The wide acceptance given the Illinois porcelain insulators by the Utilities and Electrical Manufacturers is the result of economical and dependable performance under any condition.

Distribution insulators are made from the same high grade porcelain as is used in the manufacture of the larger high voltage insulators.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

ILLINOIS

Recent Rate Changes

UNION LIGHT, HEAT & POWER COMPANY customers will be saved approximately $200,000 under new rate schedules for about twenty communities in Kenton and Campbell Counties filed with the Kentucky Public Service Commission.

CONSUMERS POWER COMPANY has reduced the electric rates of large domestic users approximately $42,000 a year. The new schedule was requested by the company and has been approved in a recent order of the Michigan Public Utilities Commission. Albert A. Wagner, commission secretary, said the reduction established 252 kw.-hr. a month as the point at which consumers are transferred from the regular rate to the special low rate known as the "objective rate." The objective heretofore was 386 kw.-hr. a month. Under the order, customers having two or more household appliances consuming large amounts of electricity, such as electric ranges, water heaters, and refrigerators will benefit.

NEW YORK POWER & LIGHT CORPORATION'S new rate schedule for commercial, industrial and other non-residential electric users (Electrical World, September 25, page 110) has been approved by the state Public Service Commission which permitted the rates to go into effect immediately. It is estimated that the complete program will involve reductions of approximately $332,000, of which the reductions now filed make $233,000.

UNITED ELECTRIC LIGHT COMPANY, Springfield, Mass., has filed downward revisions of its present residential and commercial electric lighting rates with the Massachusetts Department of Public Utilities. The new rates, subject to approval by the utilities board, will become effective November 1 and will result in a total annual saving of more than $110,000. Domestic users will receive the major share of the saving, judged at approximately $65,000. The estimated saving to commercial users is approximately $46,000. The reason given for the reduced rates is the volume of increased business which the company has experienced during the last two years. The existing schedules have been in effect since April 1, 1935, when the last reduction in residential and commercial rates was made. An annual saving of approximately $100,000 was estimated at that time. Customers of the Agawam and Ludlow Electric Light Companies are not affected by the proposed schedules. Petitions recently were filed with the Department of Public Utilities, however, proposing the consolidation of the Agawam and Ludlow companies with Union Electric. A hearing on these petitions is expected to be held soon. With the probable approval of the proposed consolidations, residential and commercial users of electricity in those two communities may benefit from the new schedules.

PENNSYLVANIA PUBLIC UTILITY COMMISSION has imposed its own temporary rates on the Solar Electric Company of Brookville, reducing customers' bills by $11,300 a year. The commission for the first time in the history of the state placed all customers on the same rate basis. Decreases will go to 1,100 of the company's 1,600 customers. The temporary schedule will continue in effect until the commission's investigation will have been completed. The commission also ordered removal of the 95-cent service charge for which no energy was received and set up a 50-cent minimum charge for which the customer will get 7 kw.-hrs. No penalties will be permitted if customers do not pay their bills within the specified prompt payment period, but the company may allow a discount up to 2 per cent for payment within a certain period. The fair rate of return fixed by the commission in establishing the schedule was 6 per cent, although the new law permits cuts down to 5 per cent. It set $200,000 as the tentative fair value of the company's property, making the return $12,000. The commission estimated the company received $25,000 under the old rates. The action in the Solar investigation is the third imposition of temporary rates under the new law.

PORTLAND GENERAL ELECTRIC COMPANY has set up a new schedule of rates for schools served by it which will save these institutions approximately $18,000 annually. The schedule is applicable to lighting, noninductive heating, cooking and incidental power when supplied to the state of Oregon, counties, cities and school districts, where funds for payment of electric services are provided entirely through taxation. The new schedule means a rate of 2 cents a kilowatt-hour for all public schools.

ILLINOIS COMMERCE COMMISSION has announced that estimated annual savings from rate reductions in September amounted to $144,736. Of this sum $144,577 represents electric rate reductions. The Union Electric Company of Illinois reduction of $110,000 was the largest for the month. Of this amount, $106,100 represents reduction in rates to small light and power consumers.

NEW YORK STATE ELECTRIC & GAS CORPORATION has filed electric rates with the state Public Service Commission to be effective in the village of Gilbertsville, Otsego County. The new schedules include the village in the territory of the company and cancels the schedule of rates of the Gilbertsville municipal plant which the company proposes to take over. The change will mean decreases to most residential users in Gilbertsville and slight increases to some commercial users.

LAKE PLACID, N. Y., has filed revised electric rates with the New York Public Service Commission which are estimated to save consumers of the municipal plant approximately $12,000 annually. The commission permitted the reduced rates to become effective October 16. Changes in the general lighting rate will save over 800 users about $9,315 a year. The new residential all-purpose rate will save users about $820 annually and the revised rate for cooking, heating and sign lighting will save customers about $1,800 a year and will replace three present separate rates.

GROTON, N. Y., has filed revised electric rates with the state Public Service Commission which are estimated to save customers of the municipal plant about $4,500 annually. The commission permitted the reduced rates to become effective October 31. The revisions include reductions in the residential and general rates of the village. The village now has three rates, one applicable to residential service, one applicable to general service and the third applicable to power service. The schedule now filed supersedes the residential and the general rates by a single all-purpose rate retaining the power rate without change.

ANDERSON, IND., municipal electric plant has been authorized by the Indiana Public Service Commission to reduce rates approximately 8 per cent. The new schedule will mean a saving of approximately $75,000 in bills annually and will affect 13,000 customers.

Municipal Plants

TARRANT CITY, ALA.—City council has authorized a $200,000 bond issue for construction of a municipally-owned distribution system. The ordinance as passed authorized the issue of 200 four per cent revenue bonds in the denomination of $1,000 each, dated to mature from 1941 to 1946. Basic rates were also fixed for four classes, the minimum monthly residential rate being 75 cents per month per meter.

MIDDLESBORO, KY.—Motion of the Kentucky Utilities Company for an injunction to restrain the city from taking any steps to get TVA power by selling $175,000 revenue bonds for a distribution system has been overruled by Special Judge J. D. Tuggle. Under the ruling the city and power company attorneys agreed that the case would be taken to the Court of Appeals.

WESTBROOK, MINN.—Residents in a special election held October 5 voted a $70,000 bond issue for a municipal light and power plant. The plant will be paid for by earnings bonds which cannot be held as a liability against property owners.

SUPERIOR, WIS.—City council recently voted issuance of $6,000,000 in bonds, $4,625,000 of which would be used to purchase the Superior Water, Light & Power Company property. Circuit Judge W. R. Foley recently ruled that the purchase of the Northern Power Company's electric property by the city is not legal because no condemnation proceedings were ever started covering these properties (Electrical World, October 9, page 146). Both Northern Power and Superior Water, Light & Power are controlled by American Power & Light Company. The city council has also adopted a resolution rejecting American Power & Light's offer to sell the two utilities to the city at a cost of $5,100,000.

MEDFORD, WIS.—Wisconsin Public Service Commission has set $87,000 as the value on the distribution system of the Lake Superior District Power Company in connection with this city's proposal to take over the property and establish a municipal plant. The city has been given four months from the time the commission's order becomes final to complete acquisition.

•

Rate Reductions Requested by Commercial Customers

Thirty-one Birmingham business firms have petitioned the Alabama Public Service Commission to order a reduction in Birmingham Electric Company's rates for commercial users. Charging that present rates are "unjust, excessive and oppressive," A. Berkowitz, attorney for the thirty-one firms, petitioned the regulatory body to order a hearing for the purpose of determining a "reasonable" schedule of rates. The petition also averred, in effect, that the complainants have been "overcharged" for electric service in the past, due to Birmingham Electric's alleged failure to comply fully with a rule of the commission, and asked that that body determine what amount of reparation is due.

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By snuffing out fires at their source, LUX (carbon dioxide) not only minimizes physical damage to equipment, but protects service against interruptions which leave a trail of dissatisfied customers in their wake.

LUX has definitely proved to public utility men that it is a fast, safe, and efficient protection against the hazards of electrical fires. In many large power stations LUX portables for hand operation and LUX built-in systems for automatic protection definitely solve their fire hazard problems.

Write for our new brochure "LUX Makes the Difference". Ask a LUX representative to demonstrate LUX protection in your plant.

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Reliable

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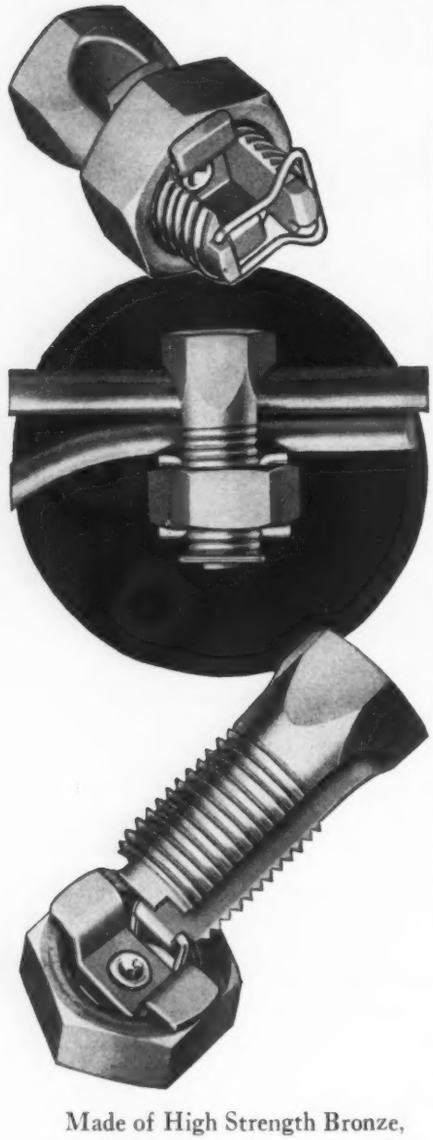

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SIOUX CITY, IOWA—Iowa Public Service Company, Sioux City, plans transmission line in part of Audubon County, totaling about 15 miles, with power substation facilities. Permission has been secured.

CAIRO, GA.—Grady County Rural Electric Cooperative, care of E. P. McLean, Moultrie, Ga., consulting engineer, has plans under way and will take bids early in November for primary and secondary lines for rural electrification in part of Grady and Decatur Counties, totaling about 75 miles, with outdoor power substations and service facilities. Fund of $75,000 has been secured through federal aid. Total system will approximate 185 miles and additional fund will be secured at later date.

ROGERS, NEB.—Nebraska Power Company, Omaha, plans extensions in transmission lines in Colfax and Washington Counties, vicinity of Rogers and Fort Calhoun, respectively, totaling about 15 miles. Application has been made for permission.

DEARBORN, MICH.—Ford Motor Company plans addition to power station at River Rouge plant, including installation of new 110,000-kw. turbo-generator unit and accessories, high-pressure boilers, pumps, and auxiliary equipment, with expansion in switching station and underground conduit lines. Work will be carried out in conjunction with a $40,000,000 development program at plant during remainder of 1937 and in 1938, to include large group of new buildings with installation of electric furnaces, heavy-duty motors and controls, regulators, switchgear, electric hoists, electric cranes and other equipment. Completion is scheduled late in 1938.

TEXARKANA, ARK.—Southwest Arkansas Electric Cooperative Corporation, Texarkana, care of William G. Morrison, Professional Building, Waco, Tex., consulting engineer, receives bids until October 28 for primary and secondary lines for rural electrification in parts of Howard, Lafayette, Miller, Nevada and neighboring counties, totaling about 156 miles, including poles, pole hardware and fittings, wire and cable and accessory equipment. Fund of $150,000 has been received through Federal aid.

BLOOMFIELD, IOWA—Receives bids until November 1 for extensions and improvements in municipal electric power station, including new diesel engine-generator unit and auxiliary equipment.

ROCKY MOUNT, N. C.—Receives bids until October 29 for equipment for expansion in municipal electric power plant, including 7500-kw. turbo-generator unit, with direct-connected exciter and complete accessories; surface condenser for turbo unit noted; motor-driven hot-well pump, turbine-driven hot-well pump, turbine-driven boiler-feed pumps, etc.; switchboard panels and instruments; complete equipment for outdoor remote control type switching station and sub-station, including oil circuit breakers, disconnect switches, transformers, battery apparatus, buses, lightning arresters and accessory apparatus; three 2000-kva. 11,950/2300-volt, single-phase, 60-cycle transformers; quantity of 15,000 and 5000-volt, three-conductor, lead-encased cable, and miscellaneous equipment. William C. Olsen, 5 Exchange Place, Raleigh, N. C., is consulting engineer.

LINCOLN, NEB.—Iowa-Nebraska Light & Power Company, Lincoln, plans transmission and distributing lines for rural system in parts of Page, Montgomery, Fremont, Taylor and Mills Counties, totaling about 35

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(In rounds, flats & squares)
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miles, with power substation and service facilities. Permission has been secured.

OZARK, ARK.—Arkansas Valley Electric Co-operative Corporation, Ozark, care of William G. Morrison, Professional Building, Waco, Tex., consulting engineer, receives bids until October 27 for primary and secondary lines for rural electrification in parts of Crawford, Franklin, Johnson and Logan Counties, totaling 224 miles, including poles, pole hardware and fittings, wire and cable, and service apparatus. Cost approximately $225,000. Financing has been arranged through Federal aid.

SEATTLE, WASH.—Puget Sound Power & Light Company, Seattle, plans addition to outdoor power substation on West Forty-fifth Street, including installation of additional equipment.

ST. PAUL, MINN.—Minnesota Mining & Manufacturing Company, 791 Forest Street, manufacturer of abrasive materials, plans installation of motors and controls, conveyors and other equipment in new multi-story plant addition, for which superstructure will begin soon. Cost close to $400,000. Toltz, King & Day, Inc., Pioneer Building, is architect and engineer.

KLAMATH FALLS, ORE.—Enterprise Irrigation District, Klamath Falls, B. W. Short, president, receives bids until October 27 for equipment for hydro-electric power station on canal power site in Klamath Irrigation District, including 750-hp. hydraulic turbine, with generator unit and complete accessories, switching equipment, station structure, trash, racks, etc. Also for transmission line from plant to point in Enterprise irrigation area.

TECUMSEH, KAN.—Kaw Valley Cooperative Electric Company, Tecumseh, Benjamin L. Pressgrove, in charge, has plans under way and will take bids soon for primary and secondary lines for rural electrification in parts of Douglas, Jackson, Osage and Waubansee Counties, totaling about 370 miles, with outdoor power substation and service facilities. Cost about $395,000, and fund in that amount has been arranged through Federal aid. Paulette & Wilson, 1006 Kansas Avenue, Topeka, Kan., and Farmers' Union Building, Salina, KAN., are consulting engineers.

MOBILE, ALA.—Hollingsworth & Whitney Company, 140 Federal Street, Boston, Mass., manufacturer of writing and other paper stocks, plans installation of motors and controls, transformers and auxiliaries, conveyors, regulators, electric hoists and other equipment in new pulp and paper mill on waterfront at Mobile, where tract of about 100 acres of land has been acquired. A power house will be built. Cost close to $5,000,000. Work is scheduled to begin soon.

FREMONT, NEB.—Has plans maturing for extensions and improvements in municipal electric power plant, including installation of considerable additional equipment. Cost estimated at $225,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

LOUISVILLE, KY.—Louisville Gas & Electric Company, Louisville, plans transmission and distributing lines in parts of Henry and Oldham Counties for rural electrification, totaling about 41 miles, with outdoor power substation and service facilities. Cost over $60,000. Permission has been secured and work will be placed under way soon.

ESTHERVILLS, IOWA—Receives bids until November 1 for extensions and improvements in municipal electric power station, including new diesel engine-generating unit and complete accessories. George W. Shadle is city clerk, in charge.

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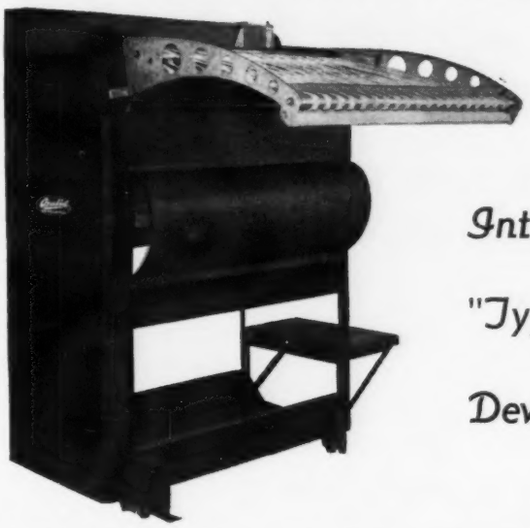

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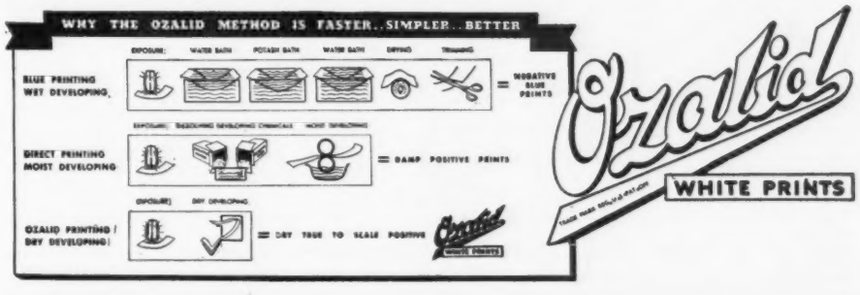

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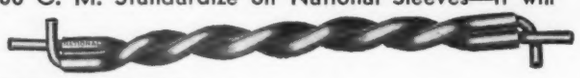

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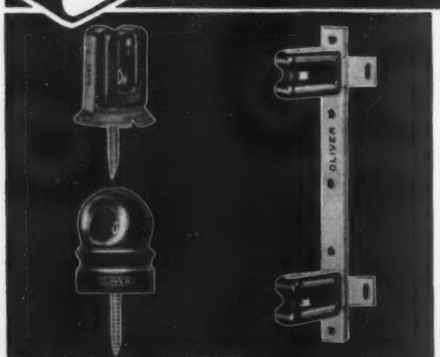

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New REA Allotments; Rural Contracts Let

Rural Electrification Administration has recently announced the following allotments:

VIRGINIA—$100,000 out of $141,000 requested, 129 miles, 391 customers in Nelson, Rockbridge, Amherst, Appomattox and Albermarle counties. Cooperative being formed. Wholesale power may be supplied by the Virginia Public Service Company.

INDIANA—Jackson County Rural Electric Membership Corporation, partial allotment $100,000, 245-mile project, Jackson and Jennings Counties, 1,147 signed customers. Indiana Public Service Company will probably supply wholesale power.

ILLINOIS—Menard Electric Cooperative, partial additional allotment $140,000 out of $448,000 requested, 395 miles, 1,197 customers in Mason, Menard, Cass, Logan and Sangamon counties. The first section, consisting of 116 miles of line to serve 348 customers, has been completed and energized. The source of power is the Central Illinois Public Service Company.

IOWA—Grundy County Electric Cooperative Association, additional partial allotment $100,000 out of $240,000 requested, 249 miles, 900 customers, Grundy, Marshall, Blackhawk and Hardin counties. Previously, an allotment of $100,000 had been made, making a total of $200,000 allotted to this project. The first section is now under construction.

KENTUCKY—Cooperative being formed, partial allotment $100,000 out of $232,000 requested, 212 miles, 895 customers, Fulton and Hickman counties, Ky., and Obion County, Tenn. Power will be supplied by TVA.

TEXAS—Cooperative being formed, partial allotment $70,000 out of $140,000 requested, 142 miles, 635 customers, Upshur, Gregg and Harrison counties. Source of power, Southwestern Gas & Electric Company. Cooperative being formed, partial allotment $174,000 out of $499,000 requested, 513 miles, 1,853 customers, Titus, Morris, Cass and Bowie counties. Source of power, Southwestern Gas & Electric Company. Deaf Smith Electric Cooperative, additional allotment $119,000, 96 miles, 146 customers in Deaf Smith County. This makes a total of $254,000 allotted to this project, and the first section is now under construction. Source of power, Texas-New Mexico Utility Company. Cooperative to be formed, partial allotment $200,000 out of $840,000 requested, 807 miles, 2,356 customers, Hidalgo, Willacy and Cameron counties.

MICHIGAN—Cooperative to be formed, $150,000, 113 miles, 412 customers, Ontonagon County. Power may be supplied by the Wisconsin-Michigan Power Company or the Copper District Power Company. Cooperative to be formed, partial allotment, $250,000, out of $504,000 requested, 455 miles, 1,720 customers in Antrim, Charlevoix, Emmet and Otsego counties. Wholesale power will be supplied by the Michigan Public Service Company.

NEVADA—Cooperative to be formed, $178,000, 94 miles, 428 customers, Clark County, Nev., and Mohave County, Ariz. Source of power, Boulder Dam.

SOUTH CAROLINA—South Carolina State

Rural Electrification Authority, allotment $265,000, 300 miles, 1,142 customers, Aiken, Clarendon, Dillon, Florence, Georgetown, Lexington, Newberry, Oconee and Richland counties. Project previously borrowed $542,328 and over 500 miles of line are being built in 21 counties, to serve about 2,000 customers.

Among the construction contracts recently signed are the following:

TEXAS—City of Bryan has awarded a construction contract to Brown and Root, Inc., Austin, for building 248.5 miles of line, low bid $184,648.

WISCONSIN—Wisconsin Power Cooperative, contract to Busch-Sulzer Company, St. Louis, generating plant in Chippewa County, low bid $196,003. Pierce-Pepin Electric Cooperative, contract to L. G. Arnold, Eau Claire, 319 miles of line, low bid $272,585.

MINNESOTA—Dakota County Electric Cooperative, contract to Langford Electric Company, Minneapolis, 205 miles of line, low bid $178,429. Scott County Cooperative Electric Association, contract to Acme Construction Company, St. Paul, 163 miles of line, low bid $163,310. Crow Wing Cooperative Power & Light Company, contract to the E. W. Wylie Company, St. Paul, 210 miles of line, low bid $177,391. Douglas County Cooperative Light & Power Association, contract to Donovan Construction Company, St. Paul, 212 miles of line, low bid $183,885. Goodhue County Cooperative Electrification Association, contract to Donovan Construction Company, St. Paul, 399 miles of line, low bid $415,280. Dakota County Electrification Cooperative, contract to Langford Electric Company, Minneapolis, 205 miles of line, low bid $178,429.

NEBRASKA—Howard County Rural Public Power District, contract to the Charles Roebuck Construction Company, Omaha, 392.7 miles of line, low bid $335,466.

ALABAMA—Baldwin County Electric Membership Corporation, contract to Richardson Trading Company, Blossburg, Ala., 211 miles of line, low bid $155,952.

WEST VIRGINIA—Harrison Rural Electrification Association, contract to Day & Zimmermann, Philadelphia, 196 miles of line, low bid $213,844.

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Milwaukee Utility Asks Bids

Milwaukee Electric Railway & Light Company has asked bids for superstructure for new addition to steam-electric generating station on East Kilbourn Avenue, 65 x 94 ft., to be used for expansion in boiler house. It is estimated to cost $1,283,000 with high-pressure boiler units and auxiliary equipment. Contract for erection is scheduled to be awarded this month.

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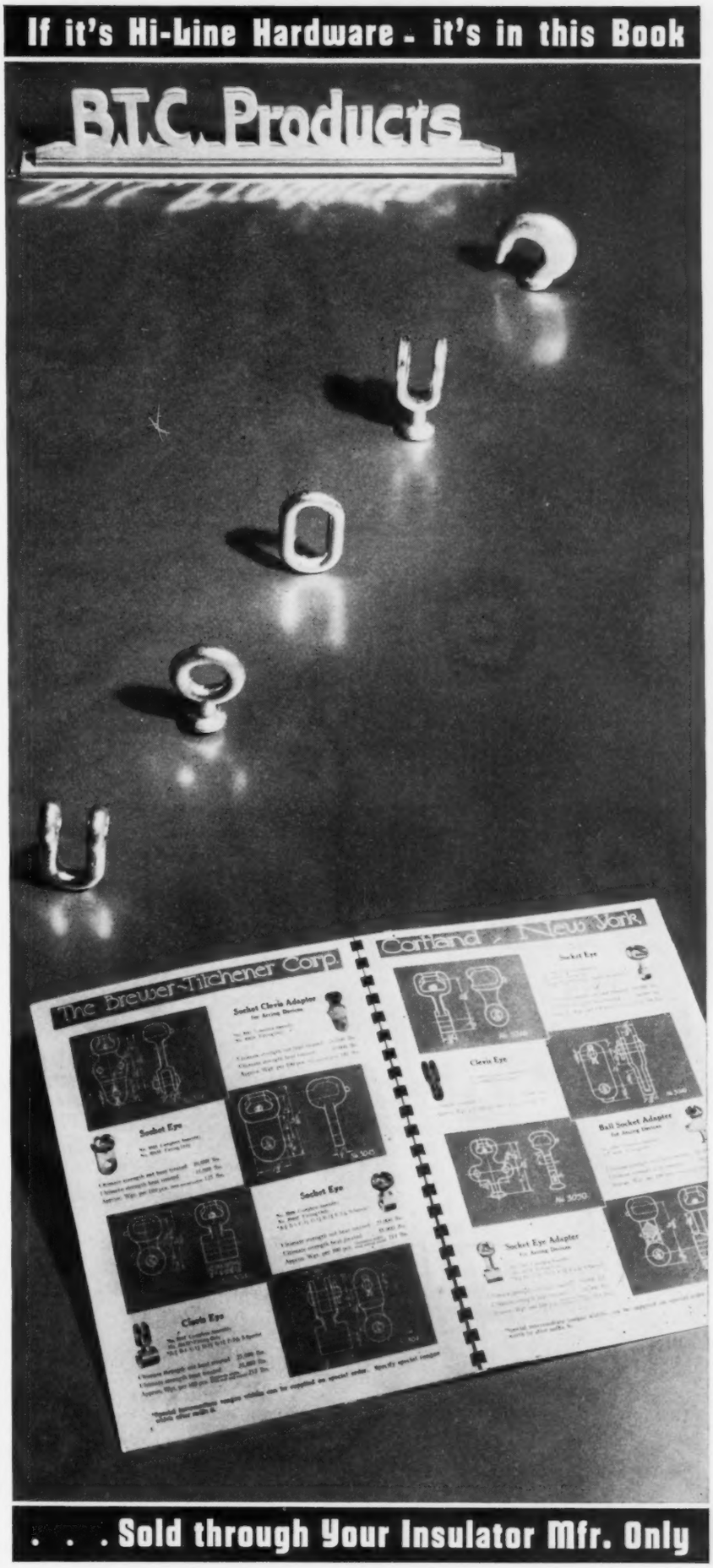
Iowa Rural Electrification

According to information gathered by the Iowa State Commerce Commission, 3,497 farms were connected to lines of private utilities during the fiscal year ending June 1, 1937. On June 1, 1936, 30.125 farms had electric service.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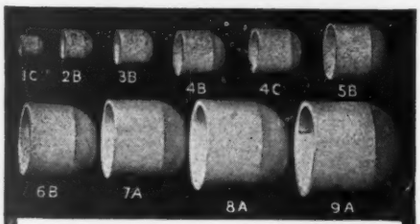

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Kelvinator Corp., Detroit, Mich.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Worthington Pump & Mchy. Corp., Harrison, N. J.
AMMETER, CLIP-ON
Columbia Elec. Mfg. Co., Cleveland, Ohio
Ferranti Electric, Inc., New York, N. Y.
ANALYSES, REVENUE
Recording & Statistical Corp., New York.
ANCHORS, GUY
Chance Company, Centralia, Mo.
Everstick Anchor Co., Fairfield, Iowa
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis Mo.
ANNUNCIATORS
Bendix Marine Products, Inc., Brooklyn, N. Y.
APPLIANCES, HEATING
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.
BATTERIES, STORAGE, ALL APPLICATIONS
Electric Storage Battery Co., Phila., Pa.
Gould Storage Battery Corp., Depew, N. Y.
USL Battery Corp., Niagara Falls, N. Y.
BLOCKS, LINEMEN'S CABLE STRINGING
Western Block Co., Lockport, N. Y.
BOILERS, STEAM
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
BRACKETS & WIREHOLDERS, INSULATED
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp. James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Porcelain Products, Inc., Parkersburg, W. Va.
Utilities Service Co., Allentown, Pa.
BRASS AND BRONZE
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Scully Steel Products Co., Chicago, Ill.
BRUSHES, CARBON
National Carbon Co., Inc., Cleveland, Ohio
Ohio Carbon Co., Cleveland, Ohio
Speer Carbon Co., St. Mary's, Pa.
BURNERS, OIL, GAS, PULVERIZED FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N.Y.
BUS BAR SUPPORTS
Burndy Engineering Co., New York, N. Y.
Delta-Star Electric Co., Chicago, Ill.
Electrical Engrs. Eqpt. Co., Melrose Park, Ill.
General Electric Co., Schenectady, N. Y.
Kearney Corp. James R., St. Louis, Mo.
MEMCO Engrg. & Mfg. Co., Long Island City
Railway & Ind. Engrg. Co., Greensburg, Pa.
Schweitzer & Conrad Inc., Chicago, Ill.
BUS BARS & TUBES
American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Scully Steel Products Co., Chicago, Ill.
BUSHINGS, APPARATUS
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Works, Trenton, N. J.
Lapp Insulator Co., Le Roy, N. Y.
Locke Insulator Corp., Baltimore, Md.
Ohio Brass Co., Mansfield, Ohio
Porcelain Products, Inc., Parkersburg, W. Va.
Thomas & Sons Co., R., Lisbon, Ohio
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
CABLE, ALUMINUM
Aluminum Co. of America, Pittsburgh, Pa.
CABLE, NETWORK
Anaconda Wire & Cable Co., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Hazard Ins. Wire Works, Wilkes-Barre, Pa.
Okonite Co., Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
CABLE, PAPER INSULATED
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
Okonite-Callender Cable Co., Passaic, N. J.
Phelps Dodge Copper Products Corp., N. Y.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
CABLE, PARKWAY
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
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General Cable Corp., New York, N. Y.
Hazard Ins. Wire Works, Wilkes-Barre, Pa.
Okonite Co., Passaic, N. J.
Phelps Dodge Copper Products Corp., N. Y.
Simplex Wire & Cable Co., Boston, Mass.
CABLE, STEEL STRAND
American Steel & Wire Co., Chicago, Ill.
Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.